

The Chemical Age

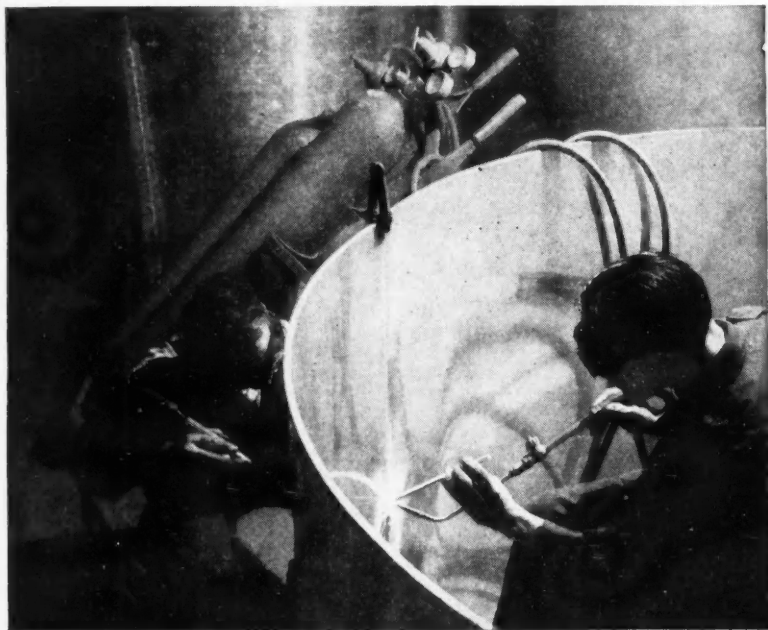
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SATURDAY, NOVEMBER 23, 1946

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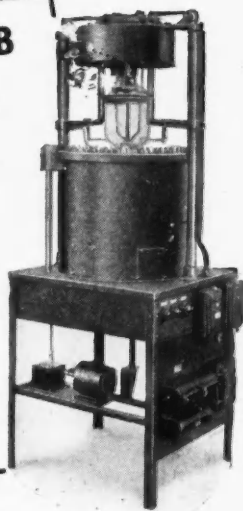
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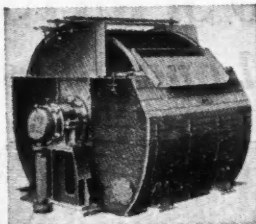


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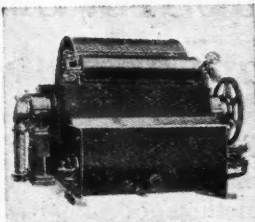
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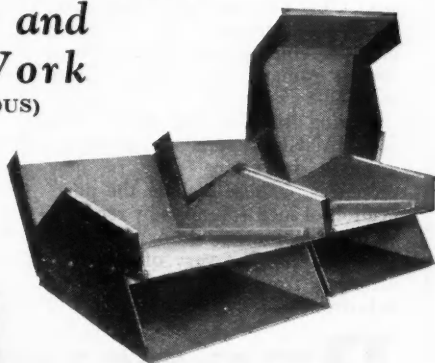
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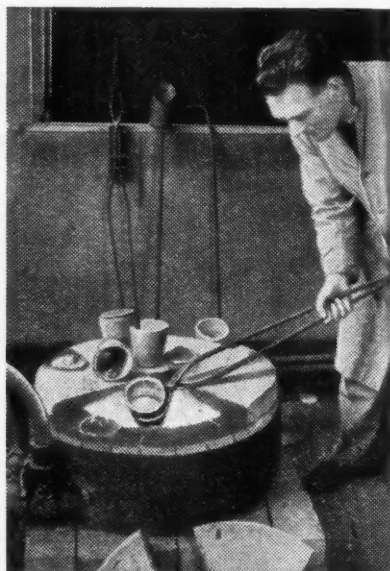
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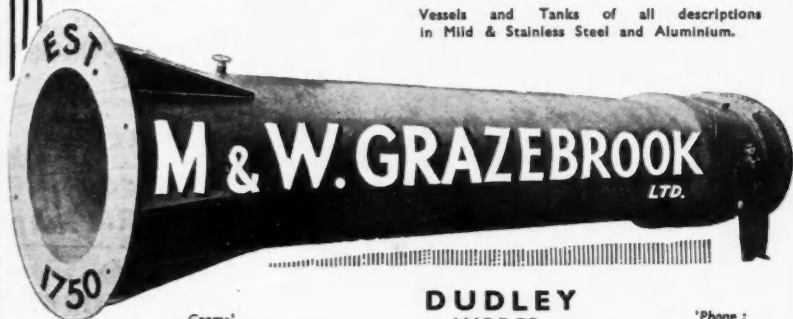
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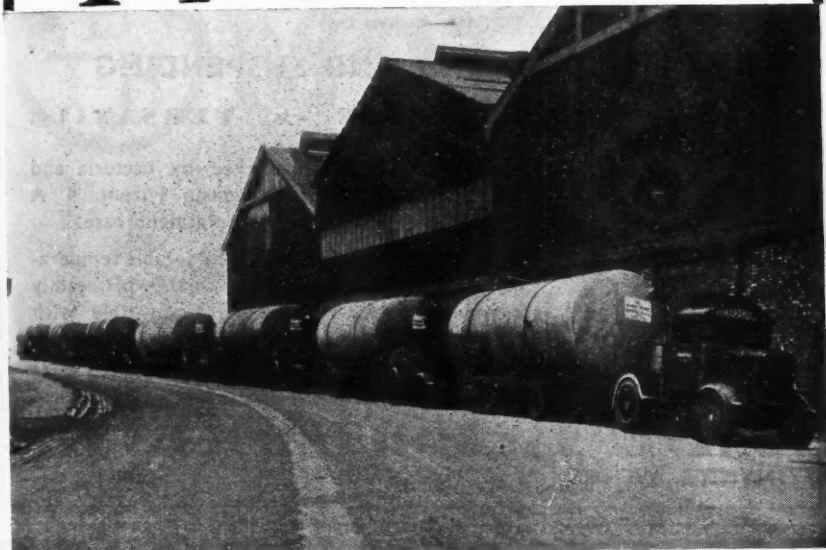
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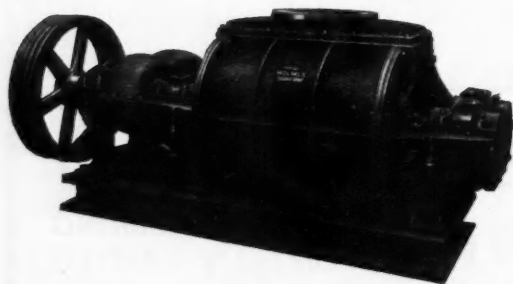
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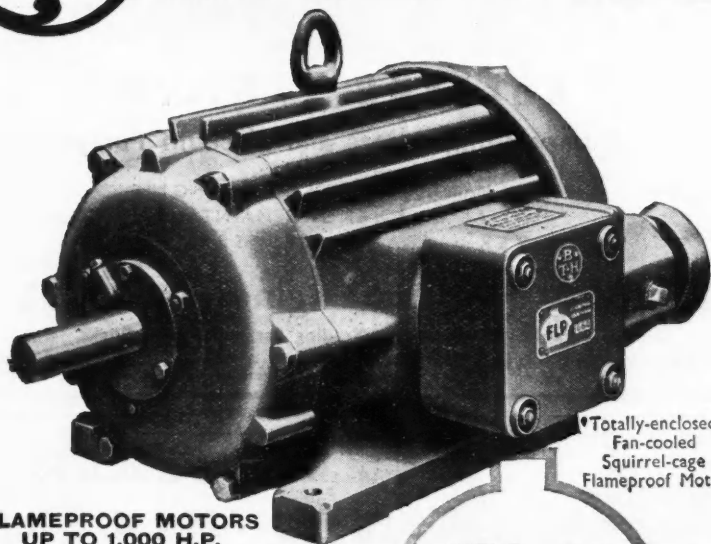
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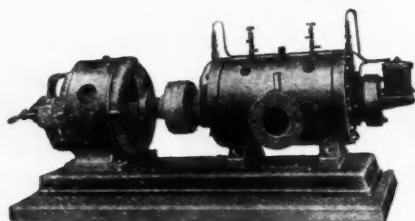
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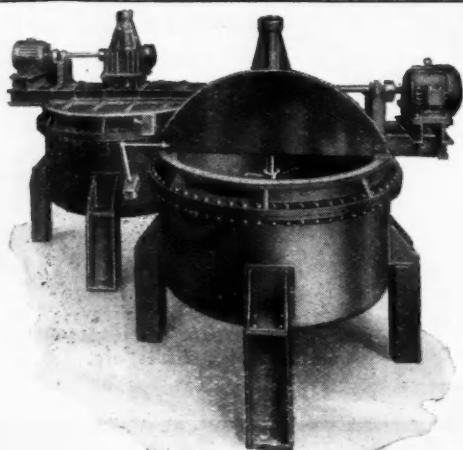
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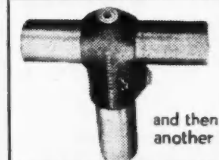
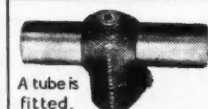
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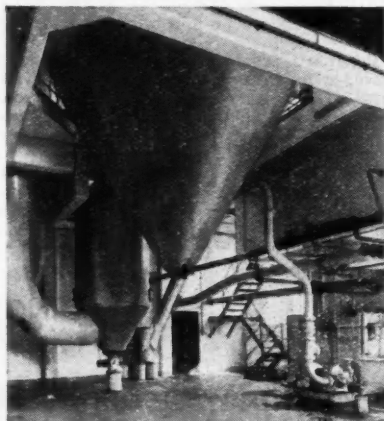
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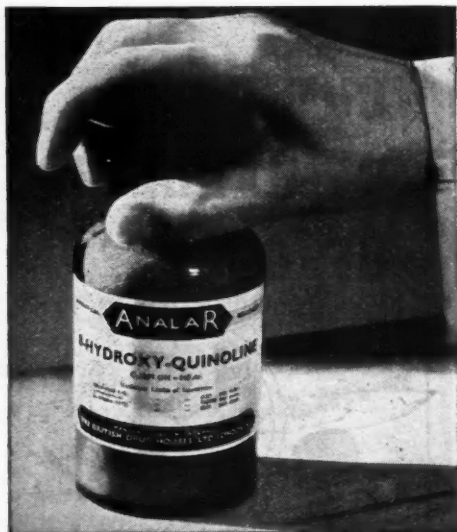
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Royal Commission on Equal Pay

IT does not seem so long ago—and many of those in later middle age can well remember it—when no “nice” girl would even dream of going out to business. When we ourselves first entered the chemical industry in the first decade of the century, the firm with which we were associated had just made an innovation that shook it to its foundations. The management had engaged three young ladies for the office staff! To be sure, in certain trades, such as hosiery and cotton, women were employed in large numbers, but these were in the lower wage groups, and the Victorian conventions were not shocked thereby. The employment of women in mines in an earlier and ruder age reminds us that at one time women worked alongside men at the hardest occupations. In still other conditions, in other countries or in other ages, women were regarded as those who did the really hard work, leaving their lords and masters to supervisory inactivity. The whirligig of time brings startling transformations. In 1938, out of some 12 million persons employed outside Government service, 25 per cent were women; by 1944 the war had brought this percentage up to 34. Women are found in every industry in one occupation or another and the fact must be faced that in this age,

men and women work together without any great differentiation between the sexes. The demand for equal pay for the sexes for similar work has been insistent for some years and impelled the Government to set up a Royal Commission to give its opinion on a change which, “if it were introduced at all, would be intended to remain in force not merely for a ‘Dunkirk period’ of fevered demand and abnormal effort, but for as long ahead as can now be foreseen.” That Commission has now reported.

There are both moral and material considerations that must affect the issue. It is an issue upon which those who write should exercise a good deal of caution. Those whose memories can travel back to the days of the suffragette movement will remember pontifical speeches by estimable

(male) Members of Parliament in which the very idea of women possessing sufficient intelligence to deal with affairs outside the home was pooh-poohed in dignified and sonorous prose. The pronouncements of those eminent gentlemen were much applauded in those days. In this year of grace we regard them with amusement. Women have emerged from the centuries during which they were brought up not to concern themselves with anything more than

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the most trivial matters, when education for women was regarded as something not quite nice and certainly not to be encouraged, into a period when they mix freely and equally with the male world and take their share in whatever political, mental, and physical movements are afoot. It may well be that bodily and mentally their adjustment is not complete yet, but to the extent that it is not yet complete, we can be sure that it soon will be. In plain fact, subject to certain physical limitations, women are likely to be the equals of men in everything but the hardest physical work. Hard physical work will probably be eliminated with the coming into existence of more labour-saving machines, and we must look forward to a world in which the sexes will be able to do equal work, mental as well as physical, given equal educational opportunities. Whether the physiologists will agree with this analysis of the future we do not know; but in view of the advances made in the work done by women within the last 50 years, we give it for what it is worth as an indication that when considering the future "as long ahead as can be foreseen," considerable care must be exercised in forming judgments.

The material side of the argument may be summed up by the question: Do women in fact perform the same amount of work of an equally high standard and in an equal time as men? *So far as the material side of the argument goes, is not this the decisive factor?* There are some lines of work in which women cannot do the same amount as men; there are others in which they can do so, but require more supervision; there are still others in which they can do more than men. Each occupation must be treated on its merits, and the treatment may vary as time goes on. A demand on *material grounds* for equal pay to-day might be refused, but might be granted in a few years' time; there can be no absolute finality.

As an illustration, the employment of women chemists in works may be cited. There is no reason why women chemists should not be just as good as men; they may not generally be engaged in industry to the same extent as men, but there would seem to be no reason why they should not, and there have been outstanding women scientists. On the other hand, we heard of a laboratory in which the women were excellent within the laboratory, but would

not go on to the works to take samples, temperatures, and so forth, on the grounds that the conditions were dirty and unsuitable for them. We do not doubt that this is a passing phase and that this difficulty will disappear in the near future; such occurrences should not cloud one's judgment of the issue.

On the moral side there is the difficulty that for various reasons women often stay in industry for a shorter time than men, and the cost of their training more often than not is wasted. Then again there is the very difficult question of family responsibilities. Some women *may* have equal responsibilities with men, but, in general, there are more people dependent on the earnings of a man in industry than those of a woman. How is this moral difficulty to be overcome? The report clearly shows that the depression of the standard of living of the family man caused by a family dependent upon him cannot be adequately compensated for by existing family allowances, income reliefs, and the benefits to be derived from the new social services. These benefits and reliefs, moreover, do not help the man who may have dependents upon him above school age. The comment has been made by one authority, with every justification, that it is upon this rock that the equal pay movement may well founder.

The report shows that in many industries and trades, the rates of pay for women is of the order of 65 to 80 per cent of that of men. In the professions, equal pay is the rule. Where the work done by women is equal to that of men, as in many professions, the principle that we have already enunciated holds, namely, that rates of pay should depend upon the quantity and quality of the work done. There seems to be no reason why chemists of both sexes should not have equal pay. On the other hand, in many industrial occupations the Royal Commission sees reasons against equal pay. Here is one: It is said that men are more adaptable and versatile than women, and more resourceful in dealing with surprise situations, and therefore worth a higher retaining wage, even though when everything is running smoothly there may be little to choose between their performances. In other words, women would not be worth equal pay as chemical engineers, works managers, or foremen in charge of industrial plant. The Commission sums up their majority view as fol-

lows: "Our own impressions are that the inferior strength of women, coupled with their shorter industrial life, their greater tendency to absenteeism, and a certain relative lack of flexibility in response to rapidly changing or abnormal situations, are still important influences tending to depress the general demand for their labour compared with men's, and so to

establish their wage at a lower level."

The Commission's report has disclosed the facts. It is for the nation to judge. We need only add that the Commission was not unanimous in its conclusions, the majority of the women members registering their dissent to the extent of claiming that the adverse features of women's work were over-estimated in the report.

NOTES AND COMMENTS

A New Directory

THE first edition of the *Directory of Independent Consultants in Chemistry and Related Subjects*, a copy of which reached us the other day, will fill a real need. Published by the Royal Institute of Chemistry, the directory contains particulars of independent consulting practices which are concerned with any of the various branches and applications of chemistry, or with certain closely related subjects, and in which Fellows or Associates of the R.I.C. are principals. Titles and addresses of the practices are given, together with an indication of the general scope of their activities and of particular fields of work in which they specialise. There is to be an annual revision of the directory and copies will be made available to all inquirers; further, the directory will be printed as an appendix to future issues of the Register of Fellows and Associates of the Institute. By these means it is hoped that particulars of all independent consulting practices in which members of the Institute are principals will be brought to the notice of industrial firms, Government departments and others who may have need of their services. This procedure will not only benefit individual consultants, who, under the ethical code of the Institute, have undertaken to refrain from advertising their individual practices, but will also serve the public interest by helping industry to obtain the best advice and assistance in the solution of its current problems and in fostering new developments. A wide range of subjects is covered by existing consulting practices, and it is evident that industrial firms, especially the smaller firms, and those whose operations are not primarily chemical, can have access to professional advice and assistance on many matters which hitherto may not have seemed to be

connected with the development of their undertaking. The arrangement of the directory is based on the titles by which the consulting practices are commonly known, in alphabetical order. In addition, there is a name index, enabling reference to be made to the practice in which any particular member of the Institute is a principal; a geographical index; and a subject index, which serves primarily as an aid to the use of the information in the body of the directory.

Austere Oxford

A CORRESPONDENT of the *Daily Telegraph*, returning to Oxford University, where he was a pre-war undergraduate, has found to his dismay that the easy, go-as-you-please, work-when-you-will attitude has been replaced by a utilitarian earnestness. The ex-Servicemen, who comprise the majority of present-day university students, cause little trouble to the authorities. One head of a college at the end of last term had only to caution two men out of some 200. But with this greater self-discipline is a greater urge to serious study with a corresponding loss of interest in matters outside their own narrow field of work. This has become so marked that some of the younger and more stimulating tutors complain that their ex-Service pupils are working too hard, too earnestly, and with too utilitarian an aim. On their part the university authorities now treat the undergraduates as men, rather than boys. After all, as the correspondent remarks, if an ex-Service major asks for leave of absence to attend a board meeting, he cannot be treated as a truant schoolboy. But this attitude, coupled with the seriousness of the undergraduates in their search for knowledge, tends to make the university atmosphere more studious, grave, and profound. The

old-time sparkle with its informal but cosy breakfasts and teas is missing—partly, perhaps, due to the housing shortage and B.U.'s. University sport has also been hit by the "no time" pleas of the utilitarians. Colleges formerly renowned for their athletic prowess now have difficulty in raising a team at all.

Time for Play

THE correspondent, viewing this change in university life with some apprehension, argues that a little less earnestness on the part of the undergraduates and a greater appreciation of other things in life outside the confines of their work would not be amiss. This suggestion is one which could well be acted on by people outside the universities. We have noticed frequently that the place where lights are burning longest is in the research laboratory. Young research chemists, full of enthusiasm, put their whole heart and soul into their work. This is reasonable. But when they try to combine this with long hours of work as well, they will find that with no outside interest to balance their minds they lack new ideas, lose enthusiasm for their work, and generally become stale. Prolonged hard work is sometimes called for in chemical research. But let it be occasional only. If it becomes a daily occurrence the employer will lose in the long run.

The Photo-Essay

THE photo-essay is a new form of photo-journalism which is being applied to commercial and industrial use. A carefully planned and scripted sequence of still pictures is used to show the various stages in the manufacture of a product or the departmental structure of an organisation. Particularly in overseas marketing is an approach of this type of great value in explaining the large amount of work which goes into the making of British goods. Few people abroad have an accurate conception of the magnitude of manufacturing organisation in this country, and photography is an admirable means of showing the overseas buyer the production resources of this country. An article dealing with the creation of a photo-essay on the production of penicillin by Mr. Jean Straker, one of the foremost exponents of this type of work, appeared recently in a photographic journal. This has been reprinted in leaflet form by Photo-Union, Ltd., the in-

dustrial and commercial photographers, who would be pleased to send a copy to any reader who writes to their offices at Studio House, 12 Soho Square, London, W.1.

Electron Jubilee Celebrations

THE fiftieth anniversary of the discovery of the electron by the British physicist, Sir Joseph Thomson, O.M., will occur next year. To mark this jubilee and to demonstrate the tremendous influence such an advance in pure physics may have on the life of the community, the Institute of Physics and the Physical Society are jointly arranging a series of meetings and other functions to take place on September 25 and 26, 1947, in London. A special exhibition which will remain open to the public for several weeks, will be held at the Science Museum, South Kensington, and will show the development of the vast range of modern industrial equipment from its earliest experimental origins.

Electrodepositors

RECENTLY restored to its rightful place after being "in store" during the war is the electrodeposition exhibit, which is now on view again in the Chemistry Section of the Science Museum, South Kensington, London. This is a condensed version of the Electrodeposition Exhibition which, it may be recalled, was organised by the Electrodepositors' Technical Society and held at the Science Museum in 1935, after which it was presented by the Society as a permanent exhibit. It covers most of the principal phases of electrodeposition, including decorative and protective plating, heavy deposition, electroforming, and electrotyping, anodising, rubber deposition, and electrodeposition research. The Electrodepositors' Technical Society, incidentally, celebrates its twenty-first anniversary this year, and the occasion is to be marked by a special gathering on December 7 at the Society's headquarters, Northampton Polytechnic, Clerkenwell, London. The first president, Mr. S. Field, is among many of the original members who have promised to be there; and representatives of sister societies are being invited. The Society continues to expand in membership and activities. An interesting programme has been arranged for the twenty-second session and over a score of new members have lately been enrolled.

The Inorganic Constituents of Coal*

Occurrence and Industrial Significance

by H. E. CROSSLEY, Ph.D., M.Sc., B.Sc. (Tech).

THE common conception of the inorganic constituents of coal is that they appear in their most familiar form as coal ash. Coal ash is not the inorganic mineral matter of coal, however; it is the residue from the ignition in air of those inorganic compounds which have not been volatilised. In most cases, 99 per cent or more of the ash consists of the free and combined oxides of the nine elements: iron, aluminium, titanium, calcium, magnesium, sodium, potassium, silicon, and sulphur. The amounts of individual oxides vary considerably, as shown in Table I, where unusually high and low amounts are italicised.

The coal minerals from which ash is derived have been described as occurring in two ways, "adventitious" and "inherent," the former class being separate from the coal, and the latter, part of the coal substance. The classification breaks down, however, as minerals may occur microscopically distinct from the coal, but intimately mixed with it. Accordingly, in this paper the minerals in coal will be discussed according to their mineralogical relationships, with a special discussion of so-called "trace elements."

The three main kinds of minerals associated with coals are shales or clays, sulphide minerals and the carbonate minerals. All three kinds are well known, the shales as hard and relatively heavy blackened lumps, the sulphides as silvery or golden patches or nodules in the coal, and the carbonates as thin white or rust-coloured plates in coal fractures. In South Wales the carbonates more commonly occur as heavy black nodules, known as "brass-stone."

Table II, from which it is clear that the shaly matter will contribute silica and alumina, with smaller quantities of the oxides of sodium, potassium, calcium, magnesium, and iron to the coal ash. Hicks and Nagelschmidt³ have examined six samples of shales overlying anthracites in South Wales, and found the main constituent to be illite, a potassium aluminium silicate of the mica class accompanied by about 10 per cent of kaolin and 1 per cent of quartz.

Most of the shaly matter occurs in bands between, above or below the coal, and it is known to be the result of sedimentary deposition of mud or silt from rivers, lakes, or swamps. It has been shown by Sprunk and O'Donnell⁴ that some shaly matter is intimately dispersed through the coal as

TABLE II.—Some Minerals Associated with the Shaly Matter in Coals

Mineral	Approximate formula
Kaolin...	$\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot x\text{H}_2\text{O}$
Muscovite...	$\text{K}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{H}_2\text{O}$
Biotite...	$\text{K}_2\text{O} \cdot \text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot \text{H}_2\text{O}$
Epidote...	$4\text{CaO} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot \text{H}_2\text{O}$
Quartz...	SiO_2
Prochlorite...	$2\text{FeO} \cdot 2\text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$
Penninite...	$5\text{MgO} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 \cdot \text{Sh}_2\text{O}$
Albite...	$\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$
Orthoclase...	$\text{K}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$
Hornblende...	$\text{CaO} \cdot 3\text{FeO} \cdot 4\text{SiO}_2$
Augite...	$\text{CaO} \cdot \text{MgO} \cdot 2\text{SiO}_2$
Cyanite...	$\text{Al}_2\text{O}_3 \cdot \text{SiO}_2$
Staurolite...	$2\text{FeO} \cdot 5\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$

streaks or spots, and that it also occurs as a filling in the skeletons of plant cells, particularly in the dull, powdery part of coal, called by Stopes "fusain."

The first significance of the shaly matter is the obvious fact that, as an incombustible substance, it is an adulteration of coal for

TABLE I.—Specimen Coal Ash Analysis

Sample number	Main constituents—per cent.									
	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	Mn ₂ O ₄	CaO	MgO	Na ₂ O	K ₂ O	SO ₂
1	40.35	34.36	16.05	1.05	0.08	1.78	0.99	1.60	1.59	1.18
2	48.30	31.85	9.29	2.77	trace	1.93	2.13	0.50	1.98	1.50
3	47.32	38.22	1.01	1.27	trace	6.29	0.78	0.39	0.89	3.63
4	28.82	25.72	31.62	0.76	trace	3.69	4.20	1.11	0.82	1.50
5	16.87	15.02	63.01	0.28	0.02	0.73	0.78	1.37	0.84	1.03
6	63.74	23.45	5.72	2.46	trace	1.43	0.72	—	—	1.12
7	25.70	33.31	10.57	0.68	1.92	13.80	1.65	3.60	2.96	5.87
8	3.04	0.41	43.92	0.33	0.67	23.94	4.22	0.47	0.11	22.98

The shaly matter associated with coals consists mainly of kaolin, micas, and feldspars, with some quartz. In the United States, Ball¹ and Gauger² have identified the individual minerals in these classes. Some of these minerals are listed in

most industrial purposes. The manner of occurrence of the shale may decide whether or not the coal can be economically cleaned, that is, freed from some of the mineral matter, for the market. Separate bands of shale might be easily removed by density separations, but it would not be practicable or economic to break the coal sufficiently to remove dispersed matter.

* A paper presented to the South Wales Section of the Institute of Fuel at the Royal Institution, Swansea, on November 8.

The nature of the individual minerals constituting the shale may be important in the studies of the causes of certain diseases of the lung, although as yet the connection has not been definitely established. A further industrial trouble which is connected partly with the shaly matter in coal is the formation of deposits on the external heating surfaces of boilers.

The only important chemical change which the shaly matter undergoes during the laboratory incineration of coal is the loss of combined moisture. In certain industrial processes, however, evidence has recently been obtained indicating further decomposition to silicon monoxide, or possibly to silicon. One of these is the manufacture of water gas, steam-raising being probably a second.

Pyrites Adulteration

The second of the main classes of minerals in coal consists mainly of iron pyrites, approximately FeS_2 . It is possible that part of the FeS_2 may occur as marcasite. The difference is that pyrites occurs as cubic crystals and marcasite as orthorhombic crystals. Pyrites is usually golden, although the colour varies, and some specimens are greyish or silvery. Marcasite is rarely golden, but usually rather steely; and whereas pyrites can often be seen to be cubic with the naked eye, the crystal form of the material thought to be marcasite is too ill-defined to permit visual identification. It is thought that the pyrites in coal may have been formed *in situ* by the action of hydrogen sulphide on infiltrated iron solutions, the hydrogen sulphide having been formed by bacterial action.

Pyrites can be seen in joints and cracks in coal, also as bands, large nodules, veins, pyritised fossils, and pyritised fusain. As with clays, pyrites is sometimes distributed in a fine state of division throughout the coal substance, making cleaning impracticable by present methods. Often, however, the pyrites content of coal can be readily reduced in amount by the usual methods of coal cleaning, including hand-picking. This led to a special wartime significance, for pyrites recovered from coal was isolated sufficiently pure to contribute to the manufacture of sulphuric acid, and thus save imports. Apart from this, however, pyrites is an undesirable adulteration of coal, being the cause of from half to two-thirds of the total sulphur present in many coals, and hence in the atmosphere of towns. When coal is carbonised part of the sulphur is volatilised, and has to be removed by recombination with iron. Oxides of sulphur are present in boiler flue gases, and these lead to corrosion of some of the cooler parts of the system and to the formation of deposited salts.

When coal is exposed to air, the pyrites oxidises to give ferrous and ferric sulphates

and free sulphuric acid, and when the pyrites occurs in the joints this change causes fracture of the coal. The result is an undesirable increase in the amount of fines present, commonly observed with stored coal.

Some coals oxidise slightly in the first few days after mining, and when these coals are washed the iron sulphates hydrolyse, contributing sulphuric acid to the washery water. Corrosion of the washery plant may ensue, particularly if the concentration of acid is raised by repeated recirculation of the water.

The third main class of minerals in coal is that of carbonates. Calcite, CaCO_3 , is common in coals, but in English coals minerals of the ankerite class occur more frequently. The latter minerals are double, triple, or quadruple carbonates of calcium, magnesium, iron, and manganese, generally 2CaCO_3 , MgCO_3 , FeCO_3 , in rhombohedral crystals. In South Wales the chief carbonate is often ferrous carbonate, and the mineral, known locally as brass-stone, approximates in composition to siderite, FeCO_3 .

Ankerite is clearly seen as thin white plates in the joints and cleats of coal, these plates becoming slightly rust-coloured when the coal is stored, due to the oxidation of the iron. Thin bands of ankerite are often associated with the shaly matter in coal, and carbonates, like the clays, can fill the cell skeletons of the powdery coal, fusain. It is probable that the main source of ankerite in coal was solutions of the respective bicarbonates, entering by infiltration and suffering decomposition, with the deposition of the normal carbonates.

Effect of Burning

When coal is burned in air the minerals are changed, and the amount of change depends on the condition of ashing. The shales lose part of the combined moisture, the amount lost increasing with the temperature. The pyrites undergoes oxidation with the volatilisation of sulphur dioxide. If each particle of pyrites has full access to air, the product of the oxidation is ferric oxide at all temperatures from 700°C . to about 1000°C . Above 1000°C . the ferric oxide tends to change to ferrous-ferric oxide, or magnetite, Fe_3O_4 . If, however, the coal is burned in thick layers, so that the supply of air is not adequate, ferrous sulphide, FeS , is formed. This accounts for the smell of hydrogen sulphide which may often be detected arising from damp domestic-grate ash, and possibly in part for the inadvisability of using domestic ashes in admixture with garden soil.

During the incineration of coal in air the carbonate minerals may react with sulphur dioxide produced by the sulphur in the pyrites and in the coal. Taking calcium

carbonate as an example, it is considered that the first product of the reaction is calcium sulphite which subsequently oxidises to calcium sulphate. These changes probably occur in the fuel beds of boilers, where the relatively high temperature can be expected to bring about a further reaction. The calcium sulphate, if formed, will be decomposed with the evolution of sulphur trioxide.

In the determination of the amount of ash given by coal, it is essential that the experimental conditions should be standardised to allow the results to be duplicated in other laboratories. For example, conditions should be arranged so that all the iron is in the ferric form, and the carbonates should be completely decomposed. These and other necessary conditions are ensured by the procedures described in the publications of the Fuel Research Station and the British Standards Institution.

The chief cause of the disagreement between analytical results is the variable fixation of sulphur dioxide by the bases present. For example, suppose coal A, rich in base and deficient in sulphur, is incinerated alone, the amount of ash obtained may be lower than if dishes containing coal A were placed behind dishes containing coal B, rich in sulphur, and incinerated otherwise under the same conditions. The bases in coal A will tend to pick up the sulphur gases emitted from coal B, making the ash heavier by the extra sulphur trioxide. To keep to a minimum the amount of sulphur fixed in the ash, and to ensure that results can be repeated, the determination of ash is best carried out in two stages, and in special muffle furnaces.⁵ The first stage requires heating to 500°C. for 30 minutes, during which time most coals are ashed, but more important, the sulphur gases are set free while the bases are still relatively inactive. The residue is then heated for one hour at 750° to 800°C. in the second furnace, to complete the breakdown of carbonates.

Other Elements

The minerals which have been discussed contribute more than 90 per cent of the ash from coal, but the remaining inorganic compounds in coal have an interest and significance which merit special consideration. In addition to the constituents of the main minerals, over 30 other elements are regularly found in British coals. It is convenient to deal first with elements which occur in small quantities associated with the main groups of minerals.

The associations with carbonates and pyrites, which are to be discussed, might be deduced, as an association of similar compounds. With shales, however, such considerations are sometimes of little use, as the shales are fundamentally collections of detrital matter from the weathering of rocks, together with the remains of animal

and vegetable bodies. Thus, in Quebec, a curious case was reported from a mica mine. There the usual situation was reversed, coal occurring as a chance associate of the mica, and in small quantities only. The ash of this coal contained 35 per cent⁶ of uranium oxide.

Presence of Phosphorus

Most coals contain from 0.001 to 0.01 per cent of phosphorus, and this is often associated with the shaly matter. Phosphorus is an essential element to the life of most plants, but the range of amounts of phosphorus in dried plants is about ten times that in coals. It is possible, therefore, that during the process of forming coal, the organic matter may have contributed phosphorus to the nearby shaly strata. This was supported by analysis of the roofs and floors of coal workings, as the shaly strata contained five to ten times as much phosphorus as the coal between. In such cases it follows that the accidental inclusion of roof shale with the mined coal, so that the ash is increased from say 5 per cent to 10 per cent might raise the phosphorus content of the coal from a negligible amount to an appreciable quantity.

A mineral named as "apatite" was recognised by Ball⁷ as in association with coal, and investigations by the present author were in agreement with this. Unfortunately, the name "apatite" has been frequently misused, as if it were the specific name of a mineral, and, indeed, it is sometimes thought that it is simple calcium ortho-phosphate $\text{Ca}_3(\text{PO}_4)_2$. Apatite is, in fact, the name of a family of minerals having the general formula $\text{Ca}_{10}\text{R}_2(\text{PO}_4)_6$. Most commonly R is fluorine, and the mineral concerned is called "Fluorapatite."

The phosphorus in coals is present as fluorapatite, which raises the point that fluorine occurs in coals, and must be considered along with the phosphorus. R. Lessing⁸ and the present author⁸ independently found fluorine in coal, in 1934. The latter work began with the investigation of the corrosion of glass bottles in an annealing kiln, found to be due to fluorine in the coal. Subsequent papers⁹ dealt with the determination, mode of occurrence, and industrial significance of fluorine in coal. It was found that British coals contain from 20 to 150 parts per million of fluorine, and that the amount of fluorine could be estimated approximately, knowing the phosphorus content of the coal.

The hydrogen fluoride released from coal during combustion in a boiler may carry off silica as gaseous silicon tetrafluoride, and this gas could be expected to decompose later, possibly with the deposition of silica on the heating surfaces. It has also been found that the phosphorus can be volatilised from a boiler fuel bed, appearing in the gas eventually either as phosphoric acid

or anhydride. When considerable amounts of phosphorus are available, the formation of troublesome deposits is seriously aggravated.

Phosphorus is undesirable in metallurgical coke, for reasons similar to those which apply to arsenic, as mentioned later.

Loss of Fluorine

When coal is carbonised the fluorapatite releases a little hydrogen fluoride at low temperatures; at higher temperatures, about 1000° C., more than half the fluorine is released, and with steaming, the loss of fluorine from the coke is complete. An excess of ammonia is present, and ammonium fluoride is formed, and dissolved by the water in the gas scrubbers. The ammonium fluoride is then hydrolysed, giving free hydrofluoric acid, which has been known to cause serious corrosion of porcelain fillings. The reaction between dilute hydrofluoric acid and silica is to form hydrofluosilicic acid and silicic acid, as follows: $3\text{SiO}_2 + 6\text{HF} = \text{H}_2\text{SiF}_6 + 2\text{H}_2\text{SiO}_3$. Unfortunately, in the presence of more silica, the hydrofluosilicic acid behaves as if it were a mixture of 2HF and SiF_4 , and while the HF is attaching the silica, as just described, the residual silicon tetrafluoride is hydrolysed to give more hydrofluosilicic acid, and more silicic acid, thus: $3\text{SiF}_4 + 3\text{H}_2\text{O} = 2\text{H}_2\text{SiF}_6 + \text{H}_2\text{SiO}_3$. Thus the fluorine is passing through a cycle of reactions, and it is clear that a little fluorine could do a lot of damage in a gas-scrubber. In fact, one millionth of a gram of ammonium fluoride might disintegrate a ton of porcelain fillings were it not for the fact that fluoride ions are adsorbed by the silica gel corrosion product. Severe corrosion has been caused in this way in gas-scrubbers, however, as recorded by Lessing. Not all the fluorine passes on to the scrubbers; some is present in the condensed mixture of tar and liquor, and at Pleau, Scotland, this led to the corrosion of the tar tanks¹⁰.

Ten years ago little interest was shown in fluoride poisoning, and only acute poisoning, by relatively large amounts of fluoride, was well known. Since then, however, the medical profession has become increasingly interested in what is now called the disease "fluorosis," resulting from chronic fluoride poisoning. The symptoms, in various stages of severity, range from teeth mottling to acute curvature of the spine and locking of the joints. In its mildest form, the disease has been correlated with the daily intake of drinking water containing more than 1 part of fluorine per million. The newly discovered significance of traces of fluorine gave additional importance to the fluorine in coal, particularly when the coal is used for the drying of foodstuffs. Considering the particular example of the drying of malt in direct-contact kilns (see also

arsenic), an examination of many samples of maltsters' coals, and the corresponding malts, culms, and beers showed that the fluorine vaporised from the coal, and was passed to the beer almost quantitatively. Fortunately, the amount of fluorine in the beers derived in this way was only about 0.6 part per million, although a few samples contained from 0.8 to 1 part per million. It must not be overlooked, however, that these were wartime beers, and that the stronger beers of peace time may require the selection of coals low in fluorine for the drying of malt.

A number of elements are to be found as sulphides, in small quantities, associated with the pyrites. It seems probable that their presence is due to the same causes as the pyrites. The most important of these elements is arsenic, occurring as the mineral mispickel, $\text{FeS}_2\cdot\text{FeAs}_2$, in amounts ranging from less than 1 to about 75 parts per million parts of coal, expressed as arsenic trioxide.

When coal is burned or carbonised, from a quarter to three-quarters of the arsenic is volatilised. The carbonate minerals help to retain arsenic, and prevent volatilisation, by forming arsenites and arsenates. Another inorganic constituent of coal increases the amount of arsenic volatilised, but this will be discussed later. The retention of arsenic in coke is undesirable if the coke is to be used for metallurgical purposes, as arsenic confers weakness on ferrous metals. The volatilisation of appreciable amounts of arsenic from burning coal is to be avoided when the combustion gases come into direct contact with foodstuffs during the process of drying. For example, this applies to the drying of malt in direct-contact kilns. For this purpose only coals known to be low in arsenic content are used by maltsters.

Copper and Zinc

Two other elements occurring as sulphides with the pyrites are copper and zinc. The amount is usually very small, but a certain Midland coal gave an ash containing over 2 per cent of CuO . This coal burned with a bright blue flame. A coal from the Cannock Chase area behaved unusually in a domestic grate, by giving dense masses of sublimate on the upper firebricks; the sublimate was yellowish when hot and white when cold, and proved to be zinc oxide. The coal contained over 1 per cent of zinc sulphide.

Lead sulphide, galena, is sometimes found in coals, and excessive amounts may have a toxic significance. Dunn and Bloxham¹¹ attributed the poisoning of some cattle to contamination of the pasture by lead and copper, which they claimed had been emitted from the boiler chimneys of a nearby factory.

It will be appreciated from the examples given that the copper, zinc and lead occur-

ring in coal are only partly retained in the ash, showing a further difference between coal ash and the original mineral matter.

In addition to the elements already mentioned, barium is usually found in small quantities, as barium carbonate, witherite. Coal ash commonly contains from 0.05 to 0.5 per cent of barium oxide, but occasionally barium has been found in coals in much greater quantities, particularly in Durham. In 1902 Briggs¹² found a vein of mixed witherite and barytes (carbonate and sulphate of barium) in the coal at Brancepeth Colliery, Durham, the thickness varying from a few inches to 16 ft. More recently, at a nearby colliery, it was observed that the coal contained much barium, the amount increasing as the working progressed. Eventually the workings reached a fault fissure, and on the other side of the fault, there was a thick vein of witherite. In the few years preceding the recent war, half the world's demand for witherite was supplied from this colliery. It is interesting to note, as a clue to the association with the coal across the fault, that the mine water was found to contain 10 grains of barium bicarbonate per gallon. At another colliery in this district, the amount of barium chloride in the mine water was sufficient to make possible the manufacture of "blanc fixe" for sale.

This ends the discussion of the main groups of minerals associated with coals, and the most important minor occurrences in these groups, but a large class of varied minerals remains to be dealt with, and they have distinct and important significances. These are the inorganic substances intimately dispersed through the coal.

Chlorine

Chlorine occurs in coals mainly as sodium and potassium chlorides, but smaller quantities of other alkali chlorides, and oxychlorides of calcium and magnesium, may be present. In addition, work done at the Fuel Research Station has shown that part of the chlorine is present as adsorbed ions, and a little is probably combined with the organic matter. Although most of the chlorine in coal is usually present as alkali chloride, only a part of this can be extracted with water unless the coal is ground to micron size (0.001 mm.), showing that part of the chlorine is intimately mixed with the coal substance.

British coals contain from 0.01 to 1 per cent of chlorine, and the larger amounts are undesirable for several industrial uses, particularly steam-raising. The presence of a relatively large amount of chlorine usually means that the coal contains a relatively large amount of sodium or potassium, and has an increased tendency to form clinker. The alkali may also attack the refractory

bricks of the combustion chamber or help to form deposits on the external heating surfaces of the boiler. The chlorine is evolved as hydrogen chloride, which seems to have relatively little corrosive action in the flue system, possibly due to the presence of other stronger acids.

When coal is carbonised, part of the chlorine is evolved as hydrogen chloride, and this is immediately neutralised by the ammonia which is always present in excess. The ammonium chloride sometimes causes partial blockage of the cooler pipes, and after hydrolysis it may cause corrosion of metal tanks. The factors governing the release of chlorine during carbonisation are those which control the loss of fluorine, that is, temperature and moisture.

Corrosion Difficulties

In steam-raising, therefore, the corrosive action of hydrogen chloride is apparently prevented by the presence of other acids; in carbonisation it is limited by neutralisation. In small mobile producer units, however, severe corrosion by hydrochloric acid is possible. In one case a medium-temperature (800° C.) coke, relatively rich in chlorine, caused appreciable corrosion of the coolers, and of the filtering material, by hydrochloric acid. When coke was prepared from the same coal at 600° C. this low-temperature coke did not cause corrosion, although practically the same amount of chlorine was present. The answer to this problem was provided by the work of Cobb and Monkhouse¹³ who found that raising the temperature of carbonisation of coal from 600° C. to 800° C. had a pronounced effect on the nitrogen compounds. An appreciable amount of nitrogen is evolved between the two temperatures, and, more important, the residual nitrogen at 600° C. is much more readily evolved as ammonia by stronger heating or steaming than is the case with 800° C. coke. Laboratory trials showed that the low-temperature coke concerned in the producer investigation would evolve sufficient ammonia to neutralise the hydrochloric acid generated, but the medium-temperature coke would not, and corrosion ensued for that reason.

The chlorine in coal has another effect, which hitherto has received little attention. The hydrogen chloride formed during the combustion of coal can react with various oxides present in the ash, to form volatile chlorides. It has been stated earlier that the amount of arsenic which is volatilised during the burning of coal depends on the fixative action of the bases present. Chlorine has a volatilising effect, as shown in the following example. A coal containing the equivalent of 60 parts of As_2O_3 per million contained only 0.02 per cent of chlorine, but was unusually rich in carbonate

minerals. When this coal was ashed, practically the whole of the arsenic was retained in the ash. Sodium chloride was added to a sample of the coal so that the chlorine content was increased to 1 per cent, and the mixture was ashed, as before. The ash now contained 25 parts of As_2O_3 per million (calculated on the weight of coal), so that the chloride had caused the volatilisation of over half the arsenic.

Rarer Elements

Over 30 elements are known to be present in different coals wholly in an intimate state of dispersion throughout the organic matter. Proof of this dispersion is shown by the fact that the percentage of these constituents increases proportionately with the removal of adventitious mineral matter, even when the coal is cleaned as far as is possible. Some of these substances may have infiltrated into the beds of decaying organic matter, before the coalification process developed, but it is also possible that they have been derived from the coal measure plants.

Boron is well known as an essential element for the life of several plant families, and it is one of the commonest minor constituents of coals. Traces of tin are found in the ashes of most plants, and it is equally common, to the extent of about 0.01 to 0.05 per cent, in the ash from clean coal. Similarly, traces of copper and zinc are common in plants and clean coal.

The occurrence of vanadium has a special interest. Ordinarily, clean coal contains at the most, faint traces only of vanadium, but in certain cases the brightest kind of coal, "vitrain," gives an ash rich in the element. This is generally true when the vitrain occurs as very thin bands in shales adjacent to the coal, or as the fossilised remains of a tree stump. Such specimens may give about one or two per cent of ash which can contain over ten per cent of V_2O_5 . It is remarkable that the ashes of some samples of Whitby jet (jet is similar in appearance to vitrain) were also rich in vanadium, and it may be that the vegetation which gave rise to these substances stored vanadium, possibly as an essential element for healthy growth. Comparatively little is known of the value of vanadium to plant life, beyond the fact that vanadium cannot replace phosphorus in the biochemistry of plants. It has been found, however, that some parts of plants may be relatively rich in vanadium, an example being pine needles¹⁴.

The inorganic matter intimately dispersed through the coal substance includes rare elements. These elements are usually present as spectrographic traces, but even so they occur in much smaller amounts, if at all, in the adjacent strata. Traces of germanium, gallium, thallium, rare earths,

gold, platinum, iridium, rhodium are often detected in the ash, of clean coal. V. M. Goldschmidt¹⁵ has suggested the following explanation. Plants such as deciduous trees have a large intake of water in the summer, and this water contains salts in solution. Normally there is too little moisture in the ground to dissolve all the commoner minerals within reach of tree roots, but occasional micro-traces of rare elements may be wholly dissolved, and taken into the tree. Thus the minerals present in the sap show a very different relationship from those in the ground, in that a much higher proportion of trace elements is present. Goldschmidt has found that the minerals in sap usually contain about 1,000 times as much of the rare elements as the ground. The sap finds its way into the leaves, and there moisture is evaporated, and the amount of inorganic matter steadily increases. Eventually the leaves fall, and rot, and the leaf-mould would give an ash which, like the salts in sap, is much richer in rare elements than the soil beneath. Occasionally, unsuspected veins of nickel, tungsten, etc., give rise to micro-traces of the element in the soil, and Goldschmidt has suggested turning this to commercial advantage. By carrying out spectrographic analyses of leaf-mould from various parts of a forest, and following directions indicated by a tendency towards increased concentration, he was able to indicate the presence of nickel in workable quantities in the ground. The method is erratic, and was said to be successful only about once in five or ten times.

Search for Germanium

The rare elements in coal may at any time have a practical value as well as an academic interest. A few years ago it had been found that tin was a good catalyst for the hydrogenation of coal. It was expected that germanium, as a sister-element of tin, would have some catalytic value. A search for germanium in British coals was organised, therefore, by the Fuel Research Board. It was found that the most promising area was that of Northumberland and Durham and the most promising seam was the Yard seam. Further, the richest parts of the Yard seam were those round Hartley colliery. In the two districts where most germanium was found, it was confined to relatively small parts of the workings, and the coal had to be cleaned so that it gave only about two per cent of ash, to remove the non-germaniferous mineral matter. Ashes were then obtained containing 0.3 to 0.5 per cent of GeO_2 , a relatively high concentration of such a rare element. The ashes which were analysed had been prepared in a laboratory muffle furnace, and it became necessary to obtain larger quantities of ash. Coal was then burned in a domestic grate, but the ashes contained only

0.05 per cent of GeO_2 . It was found that the reason for the loss was that coal burned in this way first undergoes limited oxidation with the air passing through the fuel bed. Carbon monoxide is present, and, of course, burns to carbon dioxide in the secondary supply of air above the fuel bed. Laboratory experiments confirmed that germanium was volatilised from coal by combustion in a reducing atmosphere, presumably after reduction to a germanous compound.

Following the example of the volatilising effect of chlorine on arsenic during the combustion of coal, experiments were carried out to find if this volatilising effect also applied to germanium. The experiments were positive, the introduction of 1 per cent of chlorine, as sodium chloride, to the germaniferous coal, caused the volatilisation of three-quarters of the germanium when the coal was ashed in the laboratory. This was not applied to the recovery of germanium from coal ash, as it was simpler to conserve the germanium by burning the coal in horizontal retorts.

It may be reasoned from what has already been stated, that there would be two ways of obtaining relatively volatile elements from coal. One would be by incinerating the coal in such a way that volatilisation is discouraged; this was done in the recovery of germanium. Alternatively, the coal could be burned under reducing conditions, with insufficient air passing through the fuel, to encourage gasification, the element sought being condensed from the gases. Volatilisation of the more volatile elements from coal is almost complete in some industrial boilers and in all producer plants, and condensation occurs in the flues and pipes as the temperature falls. Morgan and Davies¹⁶ examined a large number of boiler-flue dusts, and producer dusts, for the presence of germanium and gallium. In the majority of cases, Durham coal had been used. These dusts mostly contained from 0.2 to 0.9 per cent of germanium, and 0.1 to 0.5 per cent of gallium. These investigators calculated that the boiler and producer dusts of the whole country could be made to yield 2,000 tons of germanium and 1,000 tons of gallium annually. The dusts contained smaller quantities of silver, indium, thallium, cerium, lanthanum, and vanadium. There is a commercial development for the recovery of vanadium from the flue dusts of boilers burning certain fuel oils.

Combustion Gases

Brief mention has already been made of mobile producer-gas units, and the generation of hydrogen chloride and ammonia. The chief gases present are carbon monoxide, from the combustion of solid fuel in a limited supply of air, and nitrogen, residual from the air. The maximum temperature of the combustion zone is probably above

1500° C., and at this temperature a considerable amount of ammonia is formed, possibly by the direct union of nitrogen and hydrogen. The hydrogen comes from the fuel and from the action of moisture in the fuel, or in the air, on the carbon. Sulphur vapour is also present, formed by the thermal decomposition of the pyrites in the fuel, or by the interaction of sulphur dioxide and hydrogen sulphide. The sulphur dioxide comes from the preliminary ignition of the sulphur in the fuel. Sulphur trioxide is also present, as a result of the thermal decomposition of sulphates, and the hydrogen sulphide is probably formed by the action of hydrogen on the ferrous sulphide residue of the pyrites or on the organic sulphur in the coal. Hydrogen cyanide is synthesised by the direct combination of the elements, or the action of ammonia on carbon. Further reactions take place in the vapour phase, and when the gas is cooled salts are condensed. Producer gas can carry in suspension several hundred milligrams of dust per cubic metre of gas, three-quarters of the dust being solid matter blown out of the fuel bed. This is mainly the fuel itself, partly burned, with particles of mineral matter. The remainder of the dust consists of the volatilised inorganic constituents of the fuel, such as arsenic, boron, germanium, with elementary sulphur, and many ammonium salts formed by the gas reactions. Of these ammonium salts, chloride, fluoride, sulphate, thiosulphate, cyanide, and thiocyanate have been identified. Thus, producer dust is remarkable in that a considerable amount of the inorganic matter may be formed from the organic matter of coal.

Deposits on Boilers

With regard to deposits on the outside of the heating surfaces of boilers, these can also be very different in composition from the ash of the coal. The boiler surfaces act as a concentrating system for acids, alkalis, and various elements present only in traces in the coal. In a modern boiler plant, the flue dusts contain very little, if any, soot. Hard deposits can contain up to 45 per cent of phosphate (P_2O_5), however, and as much as 15 per cent of borate (B_2O_3) has been found. These deposits have become a serious problem to the electrical power industry, but further details of the problem are beyond the scope of the present paper.

This concludes a necessarily brief survey of the wide field of study concerned with the occurrence and significance of the inorganic constituents of coal. Much further study is warranted for the alleviation of industrial troubles and possibly to provide useful by-products from what is at present waste matter in coal.

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Industrial Research, and is published by permission of the Director of Fuel Research.

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Anti-Corrosive Pigments

London O.C.C.A. Discussion

At a meeting of the London Section of the Oil and Colour Chemists' Association at Manson House, 26 Portland Place, W.1, on November 13, there was a discussion on anti-corrosive pigments. Mr. R. J. Ledwith, chairman of the Section, presided.

The discussion was opened by Dr. F. Wormwell, who dealt with the electrochemical aspect of the subject. He pointed out that the natural tendency of metals was to return to the state in which they were found in nature. Stainless steel and aluminium formed oxide films that were insoluble and protected the metal, but most products of corrosion were soluble and, with moisture present, produced active electrochemical effects. Pigments were used as corrosive inhibitors, some acting as cathodic and others as anodic inhibitors. He discussed their action with the problem of the solubility of the active agent and of local leaching when the solubility was too high. With regard to ships' bottom paints, he referred to accelerated tests which indicated that under marine conditions red lead in a chlorinated rubber medium acting as an anodic inhibitor gave good results, whereas red lead in linseed oil failed and seemed to act as a cathodic stimulant.

Mr. R. M. Wilson, who dealt with the subject from the angle of a manufacturer of anti-corrosive pigments, queried what connection there was between the anti-corrosive properties of the various pigments and their composition. He complained that many tests and studies were made apparently on the assumption that such pigments as red lead and zinc chromate from all sources

were identical in behaviour. The presence of litharge in red lead could have a pronounced effect; the solubility of zinc chromates made by different methods varied widely and differed in composition from the theoretical; similarly with zinc tetrahydroxy chromate. Particle size was another factor which he considered might have a direct bearing on the behaviour of a pigment, particularly when considering films impervious to water.

Mr. N. A. Bennett said that the electrochemical theory of corrosion propounded by Dr. Wormwell was not the complete answer to corrosion troubles; a more serious factor was the extremely uneven surface of steel, often containing pockets and points that were difficult to coat with paint. He considered that contact with the surface and adhesion were the keys to the problem. Iron oxide gave protection with no electrochemical action, and he suggested that the fineness of particle size allowed it to penetrate into the defects of the surface to a far greater extent than was possible with the coarser pigments, such as ferrous ammonium phosphate; that accounted for its high qualities. Zinc and bonderising treatments were discussed, and it was emphasised that for those treatments perfect cleaning of the metal was essential. Paints were seldom applied to surfaces in ideal conditions.

In the course of a general discussion which followed, Mr. Reynolds asked for information with regard to the utility of cyanamides as anti-corrosive pigments.

Mr. Bennett said he did not think they had been used in this country to any extent. The Germans had made considerable use of lead cyanamide during the war, and he would not be surprised to hear that the Americans had also. Obviously we were not very well placed to make cyanamide here, and he doubted whether anyone had used it commercially. An American paper had referred to its results as having been very successful.

Dextrine Now Available as Glue Substitute

At the request of the Board of Trade, the Ministry of Food has agreed to make reasonable quantities of dextrine available to manufacturers who normally use glue or gelatine. It is hoped that this will help to alleviate the present shortage of glue. The dextrine will come either from home production, for which the Ministry will allocate ingredients, or from imported supplies. Manufacturers who can substitute dextrine for glue or gelatine are invited to apply to the Ministry of Food, Starch Division, London Road, Stanmore, for a permit to acquire supplies.

Cement Works at Tura, Egypt*

High Standard of Product

THERE are two cement works in Egypt, one at Helwan, the other at Tura, but the latter, with an annual production of about 280,000 tons, produces twice as much as the Helwan company. The markets for the cement are Egypt itself, Palestine, Syria, and even France and Italy. The chief demand is for ordinary Portland cement, but rapid-hardening and other types are produced when required. In regard to quality, the requirements of the B.S.S. are adhered to, in fact, the actual standard of the product is well above the specification. For instance, for 1:3 cement mortar, B.S.S.

The distance from the quarries to the crusher house is $1\frac{1}{2}$ miles. A hauling rope brings the material in buckets at the rate of 130 per hour to the crusher house. After passing through a hammer crusher, the mixture of limestone and clay is deposited into a hopper, and from there is fed into a ball mill where water is added. The ball mill is 60 ft. long, 9 ft. in diameter, and can hold 80 tons of material. It is driven by a 1250 h.p. motor, and revolves at 20 r.p.m. The mixture emerges from the ball mill in the form of a slurry and is then pumped into one or other of eight circular blending

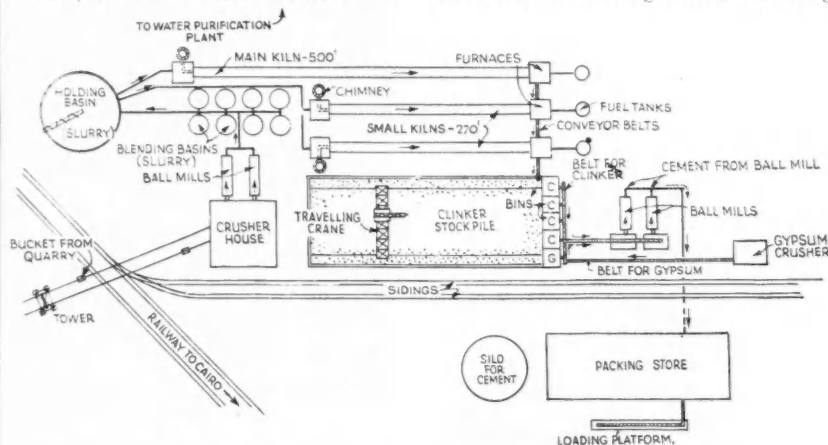


Diagram showing lay-out of Tura Cement Works (not to scale).

requires a tensile strength at three days of 300 lb./sq. in., and at seven days of 375 lb./sq. in., but the figures for the tests at three days and seven days on an average are 400 lb./sq. in. and 470 lb./sq. in. respectively. Neat cement tensile tests average 990 lb./sq. in. at seven days.

Tura is about 22 miles from Cairo, and the works, one of the largest cement works in the world, are handy for both the railway and the Nile. The limestone hills extend for nearly a distance of 100 miles, and the quarries for this material, as well as clay, contain a practically inexhaustible supply. Moreover, these two materials are easily accessible and are within handy working distance of each other. Clay is quarried at two different levels, that at the higher level containing a greater proportion of silica.

basins each of 500 tons capacity. The basins, 30 ft. in diameter, and about 40 ft. high, are built of steel plate and lined inside with an 8-in. core of concrete. From time to time, the slurry is stirred up by compressed air from a pipe in the middle of the tank. Periodic laboratory tests are made to check the lime content, and corrections made accordingly.

The slurry is next pumped to a large, circular, reinforced concrete holding basin, carrying a travelling bridge on a single rail on the tank wall. Suspended from the bridge are five revolving frames immersed in the slurry to agitate it. The slurry is then ready to enter the revolving kilns, but after leaving the holding tank it is first pumped to a tower where the quantity entering the kilns is controlled. Two of the kilns are 270 ft. in length, and the third 500 ft. This third kiln, the second longest in the world,

*Condensed from *New Zealand Engineering*

is 12 ft. in diameter, steel plated, lined with fire brick, and with a barrel temperature of 1450°C. It is supported by seven intermediate revolving bearings, which are capable of adjustment to correct the "down hill" tendency of the kiln due to its slight inclination from the horizontal. It revolves at 1 r.p.m. and is driven by an 80 h.p. motor. The charge takes four hours to pass through the kiln, from the slurry stage at the one end to the clinker stage at the other. The output of this kiln is 400 tons per day. The daily output of clinker from the three kilns is 1000 tons.

Gypsum is added to the cement to retard the setting time. Clinker is conveyed on one belt, gypsum on another, and the two are deposited into a common bin, then elevated to a measuring bin at the head of a ball mill, of which there are two, each operated by a 600 h.p. motor. The clinker-gypsum mixture (960 lb. of clinker to 40 lb. of gypsum = 1000 lb. of cement) is fed to the ball mill, pulverised, and emerges as cement. The finished product is then conveyed to the packing store and bagged in either jute or paper bags of 50 kg. capacity. By means of a rotary filler having ten radial nozzles one man can bag 70 tons of cement per hour.

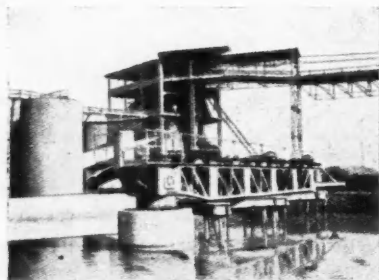


Fig. 1. Agitating the slurry before it passes to the kilns.

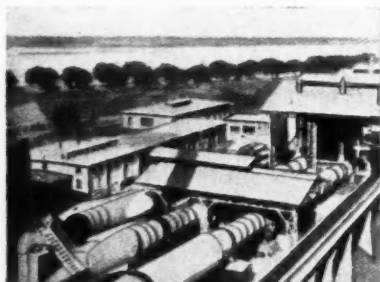


Fig. 2. The revolving kilns.

Prior to the war, coal for fuel was imported from Cardiff, and used for all firing purposes. Later it became necessary to use fuel oil produced near the Red Sea. This represents a rather expensive item, and it became necessary to adopt accurate measuring devices to check the supply and use of the fuel.

The pre-war cost of cement was £1 18s. per ton but, owing to the increases in wages, materials (and particularly the changeover from coal to oil), maintenance costs, transport, etc., the price has risen to £4 10s. per ton. The efficient layout of the whole works is a tribute to its Swiss designers.

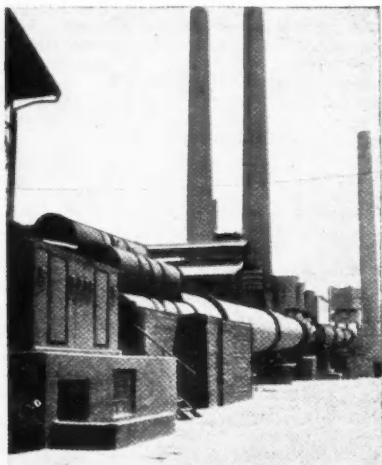


Fig. 3. This revolving kiln is the second longest in the world.

A new leaflet (No. 466) has been issued by the Visco Engineering Co., Ltd., Stafford Road, Croydon, which, with general specification and details of capacities and dimensions, and photographs of the various models, sets forth the firm's range of "Viscozone" generators. Models illustrated are the S/2 deodoriser, embodying ozone concentration control knob and circuit-breaker toggle; the ceiling model PS/8, which can also be made for rigid mounting from roof support pillars and is supplied with remote control box; FS/8, mounted on a trolley and incorporating circulating fan and "Visco" air filter; and the HP/8 type, with high-pressure blower enabling ozone to be injected into rooms with high humidity. Also shown on its special trolley is the generator type HP/24 unit.

Explosions in Chemical Works

Methods of Minimising the Results

THE second of a series of three lectures by H.M. Inspectors of Factories on "Fire and Explosion" was given at a meeting of the London Section of the British Association of Chemists, on October 23, by Dr. D. Matheson, M.A., B.Sc., Ph.D., who dealt with: "Methods of Minimising the Results of Explosion." Dr. F. W. Stoyke was in the chair.

The lecturer began by outlining methods of preventing injury to the employee:

1. Preventing the explosion by eliminating dangerous concentrations of dusts or vapours.
2. The removal of all possible ignition points.
3. The prevention of small explosions becoming big ones.
4. The protection of the employee if an explosion occurs.

It was emphasised very strongly that the removal of all ignition points was almost impossible, but the removal of as many as possible was at least an added safeguard, the prevention of dangerous concentrations of dusts and vapours being the most important precaution.

Sources of ignition are numerous and the possible precautions vary widely. To obtain indication of temperature rise where there are large stocks of organic solids, thermometers or pyrometers should be inserted; then the overheating stack can be broken down. The pyrometers can be arranged to give visible or audible warning. Overheating stacks may reach a temperature sufficiently high to flame, and decomposition products may explode. Ferrous sulphide present in steel vessels used in the treatment of sulphur containing compounds may spontaneously inflame if allowed to dry in the presence of air. The vessels should be fitted with water sprays to keep the walls wet.

Precautions

Heaters are sources of ignition; safe gas heaters are available, with all the heating elements completely enclosed. The inlet for the air and the outlet for the waste gases are carried through the wall of the workroom. Other precautions are the prevention of smoking (smokers always carry matches or lighters); the use of beryllium-bronze tools which are non-sparking; the use of shoes having no steel nails (the wooden soles are pegged to the uppers with wooden pegs); the frequent examination of bearings, etc. The use of heat-changing paint is very useful for easy checking of the temperature of bearings.

Grinding machinery is a frequent source of explosions. Grinding itself produces

heat, but the accidental ingress of pieces of tramp iron or pebbles causes considerable heat rise. Various magnetic separators are available for the removal of iron, but these do not remove pebbles. For the removal of the latter, pneumatic systems are used; the current of air blows the material upwards, while the heavy pebbles fall against the air current. This system is extensively used in coal grinding plant. Flameproof apparatus falls into four classes, depending on its suitability for use with various types of vapours or gases. For example, grade one is suitable for methane; grade two for certain organic vapours. No apparatus, strictly speaking, is available in group four, i.e., hydrogen, carbon disulphide, or acetylene. For this group all lights and electric apparatus must be outside the workroom, the lights shining in through gas-tight windows.

Static Electricity Danger

Static electricity is a serious source of ignition. It is produced by the friction of belts on pulleys, the friction of solids in cyclones, friction of liquids on solids, etc. Ethylene oxide passing along glass tubes produces static electricity. No "static" occurs if the relative humidity exceeds 75 per cent and this method is extensively employed in the U.S.A. In England, the emphasis is almost entirely on earthing, although even a very efficiently earthed vessel may still suffer. In the dry-cleaning industry a fire has occurred by sparking when a dress covered with tinsel was being removed from the cleaning vessel. Bolted flanges on metal pipes must be provided with a bonding strip; the latter must make a good electrical contact. Belts and pulleys are sometimes protected by earthed brushes and combs, but even so it is claimed that half the "static" can be missed. The most efficient method of earthing is the use of conducting belts.

The lecturer then dealt with ways of minimising the effects of the explosion. There is no method of controlling an explosion by diluting exploding substances, but cooling methods can be employed. Flames can be controlled by gauzes, but for explosions flame arresters must be used. These may consist of sheets of copper crimped between numbers of concentric cylinders, boxes containing pebbles to cool the gas, or even water may be used. Water as used in ejectors for removing fumes, e.g., from varnish pots, acts as a flame arrester. In effect, flame arresters divide a plant into small units.

Details were given of a particularly interesting system used to collect ground mag-

nesium. The collecting vessel was connected by valve with a receiver sufficiently strong to withstand an explosion; the latter was again connected through a valve with another receiver on a lower floor. The floor between the last two vessels was very strong, and the valves were interconnected so that only one could be open at any time. In this way the lowest receiver on the floor occupied by the workman could not be directly in connection with the grinding machine. Where a continuous discharge is essential, a rotary valve having vanes may be used. With screw conveyors, if a portion of the screw is removed the solids will form a plug which arrests flame or explosion. If the screw is horizontal, a baffle across the top portion of the tube is necessary, as the plug may not fill all the tube. If the flame ignites the solid, there is some risk of this ignited material being carried forward by the screw and so causing an explosion on the other side of the plug.

Secondary Explosions

A bursting panel, after it has completed its function of relieving pressure, may allow air to pass into the vessel, so causing a secondary explosion. This can be overcome by a self-sealing door. The earlier types were too heavy to be satisfactory, and caused resistance to the explosion, as they had to be opened by the explosion. Recent types are made of a very light construction, are kept open and released after the bursting panel has functioned, and they fall back on to a soft seal. The bursting panel should give a release area of 5 sq. ft. per 100 cu. ft. for organic materials, and 10 sq. ft. per 100 cu. ft. for aluminium or magnesium powders.

For aluminium settling chambers and for cyclones, brittle asbestos cement is used. This material rests on inverted T beams and is fixed with non-hardening bitumen. In the case of cyclones, the reliefs must be in both the top of the cone and the outlet pipes. Explosions have occurred in which the outlet pipe having a relief had been flattened and then the cone, which had no explosion relief, had burst. In ducting, flame arresters may not be a complete protection and in these cases the ducting should join at right angles in the form of a cross and bursting panels should be fitted at the openings opposite the ducts. When an explosion occurs, the relief ducting itself builds up pressure by reason of the inertia of the air, and reliefs should be fitted every 15 ft.

Elevators are difficult subjects, but one method employed is to build a recess in the outside wall and erect the elevator in this recess; the latter is then outside the building. All bursting panels should be in a safe place, or preferably be followed by a duct leading outside the room. These ducts must

be examined frequently to ensure freedom from blockage as the bursting panel may perforate slightly and leak dust into the duct.

A special system employed when grinding diazo compounds was then described. Each grinding machine was erected inside a room having three very strong walls, and one wall and roof made of brittle asbestos cement. Opposite the weak wall, a blast wall was built. One door was constructed to give access from the workroom. This door opened inwards so that if an explosion occurred the wall would support the door. A special key was used both to start the motor (the starter being in the workroom) and to lock the door. The key would not be removed from the starter when the machine was running, or from the door unless the latter were locked.

During the discussion which followed it was stated that no explosion had occurred during the grinding of zinc, but one could occur with the very fine dust met with when zinc was distilled; also, carbon black had never caused an explosion. The lecturer said with regard to pipes containing solvent it was desirable for these to be below ground level, but the duct must be of impervious material, otherwise leaking solvent would enter the ground and might reappear some considerable distance away. It was also mentioned that in some works the apparatus was being constructed of very strong materials capable of withstanding the pressures obtaining when an explosion occurred. These pressures are about 100 lb. per sq. in. Strong relief pipes, about 6 in. diameter, are attached to the apparatus to allow the pressures to fall to normal. These pipes are fitted with bursting panels.

New Control Order

Copper and Zinc Selling Prices

THE Control of Non-Ferrous Metals (No. 25) Order (S. R. & O. 1946, No. 1821), increases the maximum prices at which copper and zinc may be sold in the United Kingdom. Maximum prices are increased per ton as follows: Copper, by £14; zinc, by £5; zinc sheets, by £5; zinc oxide, by £4. Holders of valid licences to purchase copper and zinc metal (as sold by the Directorate of Non-Ferrous Metals), granted on or before November 12, 1946, may, on application to the Directorate at 20 Albert Street, Rugby, cover themselves by purchases, where they have not already done so, against such licences up to and including November 30, 1946, at the maximum prices ruling on November 12, 1946. Inquiries should be addressed to the Directorate of Non-Ferrous Metals, 20 Albert Street, Rugby.

Developments in Electrometric Analysis

Some Aspects of Physical Methods

A COMBINED meeting of the Cardiff and District Section of the Royal Institute of Chemistry, the Physical Methods Group of the Society of Public Analysts, and the South Wales Section of the Society of Chemical Industry was held recently at the University College, Cardiff, when three papers were presented. Mr. R. C. Chirnside, F.R.I.C., chairman of the Physical Methods Group, occupied the chair, and the first paper was given by Mr. A. D. E. Lauchlan, M.A. (of the Cambridge Instrument Co., Ltd.) on "Recent Developments in Apparatus for pH Measurement and Electro-Titrations."

Mr. Lauchlan said that the use of the thermionic valve in a pH measuring device had enabled manufacturers to supply an instrument which was so robust and simple to use that even the unskilled and semi-skilled workers were now able to make precision measurements. One of the aims of the instrument maker had been to produce electrodes as robust as the associated instrument, and to this end thicker glass electrodes had been produced. Mr. Lauchlan pointed out that the difficulties of making stronger glass electrodes had not been in the actual blowing of the bulb but in the arranging of conditions so that the very minute amount of energy available could be applied to the measuring circuit without appreciable loss.

Advantages of Purity

It had been found that the best results were obtained if the glass was made from very pure materials, so that impurities, chiefly Al_2O_3 , were kept down to as low a value as possible, generally 0.25 per cent. The production of pure glass enabled manufacturers to make very small electrodes which were yet sufficiently conducting to give theoretical results over the same range as the normal electrode. These small bulbs, which may be only 2.5 mm. in diameter, were exceedingly useful for examining small quantities of material or for carrying out electro-titrations on a few drops of liquid, such as might be used in a Conway vessel.

Probably the most outstanding improvement in glass electrode performance was the production of a glass which was less sensitive to sodium ions and enabled accurate measurements to be made up to pH 14, and in solutions stronger than N. The improvement in performance could be judged from the fact that the normal glass electrode had a sodium error of about 0.6 pH at 12 pH, whereas the new glass reduced this error

to zero even on a solution of N. sodium ions. While it was necessary to know the sodium ion concentration in order to apply the appropriate correction to obtain the best results, the error introduced by an uncertainty of the ion concentration was not nearly so serious. The general accuracy of this new glass electrode was about 0.02 pH.

Simpler Apparatus Required

Mr. Lauchlan pointed out that in spite of the fact that the literature on potentiometric titrations extended back over a considerable number of years, there did not seem to have been any great application of the methods until the last war. Possibly the need for a large number of routine analyses to be carried out by semi-skilled workers proved the need for a simpler apparatus than had been available before. The earlier forms of electro-titration apparatus, developed mainly by Dr. Sand, were rather akin to some of the earlier pH meters and did not lend themselves to easy operation or understanding by the semi-trained. The use of the hydrogen electrode, with all its attendant troubles, no doubt accounted for its lack of popularity.

Mr. Lauchlan expressed the opinion that the so-called "magic eye" indicator had not so far replaced the galvanometer in English pH meters as had already happened in some cases in America, probably because the range of valves suitable for convenient incorporation in the instrument were not yet readily available here. The modern galvanometer and the "magic eye" were now competing for the place of detector, and here, at any rate, the "magic eye" seemed to have an advantage since it could be mounted on the burette stand. The slightly lower sensitivity of the "magic eye" detector was not so important here as, unless the conditions of the reaction going on in the beaker were not well chosen, there should be a reasonably large change of potential at the end-point. He thought, however, that he might be permitted to remind the user that, no matter how good the instrument may be, the best results could not be obtained unless the conditions of the chemical reaction were properly arranged, for the indicator electrode could only pass on to the detector the result of the change which it experienced in the reaction.

The second paper was given by Mr. R. J. Carter, B.Sc., of the I.C.I. Paints Division, Research and Development Department, Slough, and dealt with "Some Applications

of Electrometric Methods to analysis." Mr. Carter reviewed a few of the more useful electrometric methods available for use in quantitative analysis, and some new trends in analytical research prompted by those methods. He illustrated his lecture with a number of graphs, and confined his references to potentiometric titrations divided into sub-groups of acid-alkali, precipitation, and oxidation-reduction types, concluding with some considerable reference to the mechanism and application of the Karl Fischer reagent electrometric method for determining small amounts of water.

Acid-Alkali Titrations

Dealing first of all with the acid-alkali titrations, he pointed out that the relative ultimate accuracy of indicator and potentiometric methods largely depended upon the appearance of inflection in the neutralisation curve. In general, the latter is governed by the magnitude of the product KC relative to the ionisation constant of the solvent, where K is the ionisation constant of the weak acid or base and C is the concentration constant of the solvent. Apart from the obvious application to titrations of coloured solutions, the use of the potentiometric method was of value where the indicator end-point was evanescent, such as with weakly dissociated acids or bases, a practical example being heavily bodied vegetable oils. The reaction towards the end of the titration may be slow, requiring some time for a steady e.m.f. reading at each addition, but the graphical calculation of the equivalent point would be accurate and would give a result truer than that obtained with an indicator.

Coming to the precipitation and oxidation-reduction type titrations, Mr. Carter said the use of electrolyte bridges in potentiometric titrations where a bimetallic system could not be employed quite often had the disadvantage of the risk of contaminating the test solution. Polarisation end-points provided a type of titration which was finding increasing use. A characteristic feature was the rapidity with which the system reached an equilibrium at each addition of titrant near to the end-point as opposed to the pause usually necessary with orthodox potentiometric end-points.

The importance of the Karl Fischer reagent as a quantitative reagent for the determination of small amounts of water was evident from the volume of published work on this subject. It would appear that the applications were almost without limit, and in fact, foundation for further work in the quantitative analytical organic field had been truly established by the work of Smith, Bryant, and Mitchell. They had utilised the production or use of water in a number of organic reactions as a means of estimating organic radicals.

Karl Fischer had suggested the use of an electrometric end-point where the visual titration was not possible, and later Almy, Griffin, and Wilcox had described the potentiometric back titration of excess Fischer reagent with a standard water solution using a platinum-tungsten electrode pair. Disadvantages were the usual wait until equilibrium was reached after each addition and the need for resensitising the tungsten electrode.

In the third paper of the evening on "Polarisation End Points" Dr. D. P. Evans, Ph.D., M.Sc., pointed out that the advantage of the use of polarised electrodes in certain titrations were the remarkable accuracy coupled with simplicity and cheapness of the apparatus; its usefulness in coloured or turbid solutions; and the rapidity at which readings could be taken.

The use of polarised electrodes in the titration of thio-sulphate with iodine was fully described in order to illustrate the method. A small potential of about 15 m.v. (smaller than the maximum back e.m.f. developed) was applied to two platinum wire electrodes immersed in acidulated thiosulphate solution. The solution was mechanically stirred. Owing to the reducing action of thiosulphate the anode was completely depolarised and the back e.m.f.—which becomes immediately equal to the applied voltage—is due entirely to polarisation of the cathode. Addition of some iodine caused a momentary excursion of the galvanometer spot from the zero position, but this was rapidly regained, owing to the redevelopment of the back e.m.f. At the end-point the galvanometer spot was permanently displaced in the direction required by the condition: applied e.m.f. > back e.m.f.

Ensuring Accuracy

A definite condition for accuracy—more especially in weak solutions of the order of 0.002 N.—was that there must be sufficient reducing agent present throughout the titration to keep the anode depolarised. In the titration demonstrated by Dr. Evans this was ensured by adding some iodide ions as potassium iodide.

The method has been applied, said the lecturer, to give an expeditious method for determining dissolved oxygen in boiler-feed water. He referred students to Evans and Simmons (*J.S.C.I.*, 1944, 63, 29-30). It might also be used for determining chlorine in domestic water supplies. Polarisation and depolarisation of an "inert" electrode had also been employed to measure chlorine in drinking water by the automatic recorder. In the fall in potential due to the depolarisation of a cathode by the dissolved chlorine, a current is caused to flow through a resistance, and the fall in potential along this resistance was proportional to the chlorine contained in the water.

Technical Exhibition

Chemical Displays in Kelvin Hall, Glasgow

THE Technical Exhibition which was opened in the Kelvin Hall, Glasgow, on November 15 and will remain open from 10 a.m. to 8 p.m. daily until Wednesday, includes a number of interesting displays by firms closely concerned with the chemical industry.

The Mirrlees Watson Co., Ltd., chemical engineers, have a display of steam-operated air ejectors, including carbon-lined types of ejectors, manufactured in conjunction with the Morgan Crucible Co., Ltd., for dealing with corrosive gases and vapours. They also show de-aerators and pumps for water, milk, corrosive fluids, oils, greases, and similar units. The allied company, Blairs, Ltd., of Glasgow, show a model of a continuous three-column alcohol still for the production of high-strength neutral alcohol from molasses.

Lewis Berger (Scotland), Ltd., who are hoping shortly to expand their Scottish

plant, in Glasgow, to cope with increased business, show Kemplastite, Hy-Meg, and Dimenso finishes. The immense advances in electrical insulation involving the use of superior varnish finishes is stressed in the exhibits on show here. Marconi Instruments, Ltd., have a considerable range of electronic instruments for measurement of industrial conditions, perhaps the most important from the chemical viewpoint being the pH meter, a mains-operated type for determination of pH content in solutions in use in a wide range of industries. The Morgan Crucible Co., Ltd., show a wide range of newer uses of Morganite carbon, including bearings, valves, rings, reamers, dies, and moulds, utilising the chemical inertness and heat and shock resistance qualities of the material for application in fields far removed from the more generally known electrical field.



The stall of Benn Brothers, Ltd., at the Technical Exhibition, Glasgow.

Parliamentary Topics

German Scientists

IN the House of Commons this week, Mr. Mayhew, in reply to a question by Mr. T. Reid, said the subject of the deportation of Germans to the U.S.S.R. from the Soviet zone of Germany had been actively discussed at all levels of the quadripartite machine in Berlin and, as it had been impossible to reach agreement, the whole question had been referred to the Allied Control Council.

Mr. Gammans asked the Minister of Supply whether the German scientists who had come to this country were engaged on a voluntary agreement and what were the terms of that agreement.

Mr. Wilmot: The agreements, which are entirely voluntary, offer employment to these scientists for six months in the first instance and are subject to renewal by mutual agreement. The contract may be terminated earlier on compassionate grounds or for other reasons at the department's discretion. The salaries offered are graded according to qualifications.

Sulphate of Potash

Asked by Mr. Medicott if he were aware of the shortage in supplies of sulphate of potash available to commercial fruit-growers and if he would arrange for some allocation at an early date, the Ministry of Agriculture said he was aware of the shortage and regretted it was unlikely that supplies would be sufficient to make allocations, whether of sulphate or other forms, this season.

Mr. Medicott further asked if the Minister were not aware that a certain amount of potash was at present being produced in the British zone of Germany, the greater part of which went to Holland, and whether he could not arrange for some proportion of this to be allocated to the U.K.

The Minister doubted whether potash produced in Germany was going to Holland. "We are aware of all that we can do to improve supplies," he added.

Streptomycin Tests

A question was addressed to the Lord President of the Council by Colonel Crosthwaite-Eyre, who asked what provision had been made by his department for research into the use of streptomycin and whether any money had been allocated for research production of this drug.

Mr. Morrison's reply was that the Medical Research Council had arranged for controlled clinical trials of streptomycin, as soon as supplies were available, to determine its value in tuberculosis and other conditions, and the best method of its use. Funds were being allocated for this work, including the making of purchases.

Egyptian Patent Law

An Interesting Proposal

A MODERN patent law has been drafted in Egypt and it is expected that it will be enacted soon, states a pamphlet on industrial developments and commercial conditions in Egypt, which has been prepared, with special reference to patent, design and trade mark matters, by F. Lysaght, of Lysaght & Co., Patent and Trade Mark Attorneys, P.O.B. 1795, Cairo.

It is expected that the new law will provide for the grant of patents for a term of 15 years, subject to the payment of annual renewal fees. It is probable that, during the first few years, the Egyptian authorities will not make an official search and examination as to the novelty of inventions before granting patents, and that they will limit their investigation to that of examining specifications as to the clarity of the description of the invention to be patented.

At present, and until the new law comes into force, the protection of inventions and designs in Egypt is secured by registrations effected in the Mixed Court of Appeal, and there is no doubt that the existing rights of the owners of these inventions will be recognised under the proposed new legislation, by granting them facilities to apply for a patent under the new law with priority rights as from the date of filing, in the Mixed Court of Appeal, of the original application for protection of the invention.

Pending the coming into operation of the new patent law, it is essential that new inventions should continue to be protected by registration in the Mixed Court of Appeal, because the prior use or publication of an invention in Egypt, before the date of filing an application for a patent under the proposed new law, will prevent the grant of a valid patent being obtained.

New designs for pattern, shape or configuration of articles will continue to be protected by registration effected in the Mixed Court of Appeal, and a new statute law for the protection of industrial property will, it is assumed, be enacted within the next year or two.

Perhaps best known as drum manufacturers, Todd Bros. (St. Helens and Widnes), Ltd., have published an informative and readable booklet covering another side of their output—their chain products. In addition to details of the firm's products in this line, text and pictures are included introducing both the works where they started manufacturing in 1859 and where they still produce their hand-made chains and the department where their electrically-welded steel chains are made.

German Technical Reports

Some Recent Publications

SOME of the latest technical reports from the Intelligence Committees in Germany are detailed below. Copies are obtainable from H.M. Stationery Offices at the prices stated.

BIOS 550. Investigation of beryllium production in Germany, and Italy, including production and uses of oxides and alloys (10s. 6d.).

BIOS 654. Lead-zinc copper mining in the Harz and lead-zinc mining in the Ruhr coalfield (23s. 6d.).

BIOS 657. German laboratory porcelain industry (1s. 6d.).

BIOS 697. Fire protection of oil installations in Germany (4s.).

BIOS 758. *I.G. Hoechst*: Manufacture of crotonaldehyde and crotonic acid (6d.).

BIOS 773. *I.G. Farbenfabrik, Wolfen*: Manufacture of photographic developing substances (3s.).

BIOS 775. *I.G. Hoechst*: Manufacture of butanol, methoxybutanol, butyraldehyde, and glycerogen (2s.).

BIOS 790. *Krupp A.G., Essen*: Armour plate: Notes on gas carburising process (1s.).

BIOS 791. *Interrogation of Dr. H. Roelig*: Dynamic properties of rubber (6d.).

BIOS 792. *Interrogation of Dr. P. Stocklin*: Properties and testing of rubber (1s. 6d.).

BIOS 800. *Interview with Dr. Becker*: Chemistry of polymerisation as applied to the preparation of Buna synthetic rubbers (1s. 6d.).

BIOS 805. Aspects of the synthetic fatty acid and synthetic fat industries in Germany (11s.).

BIOS 818. Notes on German iron and steel foundries, including centrifugal casting (3s. 6d.).

BIOS 820. Tungsten carbide: Notes on Krupp Widia plants (4s.).

BIOS 825. Steelmaking: Notes on German practice (7s. 6d.).

BIOS 826. Investigation of German researches on fine structure of metals, with special reference to X-ray diffraction techniques (2s.).

FIAT 299. Supplemental report on the Ruhrlor Hydrogenation plant, Welheim, Ruhr (1s.).

FIAT 387. German steel casting industry (13s.).

FIAT 430. Survey of the soda ash and caustic soda plants of Western and Southern Germany (2s. 6d.).

FIAT 447. Study of production of shale oil from shale in Wurttemberg (9s.).

FIAT 617. Electrical and technical ceramic industry (13s.).

FIAT 655. Synthetic sapphire and spinel production (1s. 6d.).

FIAT 706. Report on selenium dry rectifier developments (5s.).

FIAT 733. Vertical retort zinc and by-products (3s.).

FIAT 744. Salicyclic acid (1s.).

FIAT 789. Experiments to produce ductile silicon (1s.).

FIAT 798. Titanium metal produced by Degussa and Osram (1s.).

Non-Ferrous Scrap Metals

Latest Prices

THE Ministry of Supply has issued a list of selling prices of non-ferrous scrap metals at Ministry of Supply depots, where sales will be held when sufficient material of the quality required is available. The list refers to delivery until the end of February and is published without prejudice or commitment. Inquiries regarding the list should be addressed to Directorate of N.F. Metals (Scrap Disposals Department), 41-43 Norfolk Gardens, London, W.C.2.

The following is a summary of the prices per ton of the various classes of scrap listed: Copper—scrap, £88 10s. to £91 10s.; turnings, £80. Zinc—scrap, £44. Brass—scrap, £62 10s. to £76 10s.; turnings, £63 10s.; 70/30 metallics, £57 10s.; 60/40 rod swarf, £56 10s.; 60/40 broken down fuse scrap, £65 10s.; 90/10 gilding metal scrap, £82 10s. to £85; 95/5 cap metal webbing, £86. Scrap bullet envelopes—cupro-nickel, £90 10s.; gilding metal, £71 10s.

K.I.D. EXEMPTIONS

The Board of Trade is now giving consideration to the question of renewing the Safeguarding of Industries (Exemption) (No. 4) Order, 1946, under which exemption from Key Industry Duty until December 31, 1946, applies to certain chemicals and chemical substances, a complete list of which was published in THE CHEMICAL AGE on August 24 last (see p. 236). Any communications in reference to this matter should be addressed to the Industries of Manufactures (General) Division, Board of Trade, Millbank, London, S.W.1, before December 9.

Developments in the processing of vegetable and animal oils and fats are of particular interest to-day, and the London Aluminium Co., Ltd., Westwood Road, Witton, Birmingham, has given special attention to designing improved types of refining and deodorising plants for handling these products. Information about these plants is given in List No. D.O.15, while another recent publication, List No. V.S.14, describes vacuum stills.

Plan For A Port

Development of Kingston-upon-Hull

GENERALLY speaking, the chemical industry is more likely to be interested in the lay-out of a trading estate than in the broader planning of a town. With the growth, however, of the chemical export trade, the future of our ports becomes of increasing importance to the industry, a fact which becomes more strongly emphasised when the port has a close and long-standing connection with the chemical industries. This applies quite distinctly to the port of Hull, where the seed-crushing and vegetable-oil industries are old-established, and where the paint and general chemical industries have been expanding for some time past.

Hull is the third port of England, and although it suffered a particularly vicious and prolonged series of attacks from the enemy during the war, it never ceased to maintain the advantages it would have as soon as conditions became normal. Now, its active citizens have produced a plan for the future, prepared for the City Council by the late Sir Edwin Lutyens and Sir Patrick Abercrombie. It would be difficult to find two greater authorities on the subject, and the plan they have prepared is worthy of them and their capable assistants. It is published by the Hull firm of A. Brown & Sons, Ltd., at the price of 15s.—a most moderate figure.

New Industrial Plan

When examined alongside other schemes for the future of our battered British cities, the Hull plan is outstanding for clarity and excellent production. For obvious reasons, this is no place to publish a full review, but our readers' attention should be called to the section on industrial development and zoning. As in most other cities that grew rapidly in the 19th century, the industries of Hull, though partly concentrated in certain areas, are also, in large part, distributed throughout the residential areas, to the detriment of both industry and residents. The new plan sweeps away these isolated factories, and increases the available industrial areas by way of compensation. It is refreshing to note that such considerations as the disposal of effluents and the prevailing direction of wind (especially when volatile gases have to be thought of) have met with due attention. Still more agreeable is the amount of attention that has been paid to the amenities, not only in the preservation of the surrounding countryside—a safety-valve for the workers—but also by the creation of urban open spaces in key positions now incongruously occupied by industry.

The production of such a volume is a difficult task, especially in these times, and it

has been well carried out. The one fault we would find is that the name of that distinguished geographer, Professor Rudmose-Brown, has been consistently mis-spelt.

Iron and Steel Output

U.K. Figures again show Increase

PRODUCTION of pig iron and steel in the U.K. during October again showed an increase over the previous month's figures. Pig iron output was 623,200 tons, equivalent to a rate of 8,101,600 tons a year, compared with 584,400 tons (annual rate, 7,598,200 tons), for the same month last year. Steel production, in spite of fuel difficulties and limitation of transport, was 1,017,200 tons (annual rate, 13,226,000 tons) compared with 972,800 tons (annual rate, 12,648,000 tons) for October, 1945. Figures given in the tables below represent tons.

PIG IRON

	1945	1946
	<i>Weekly</i>	<i>Weekly</i>
	<i>Average</i>	<i>Average</i>
First quarter	134,500	145,500
Second quarter	132,600	150,500
Third quarter	132,600	146,600
September	139,300	147,300
October	146,100	155,800

STEEL INGOTS AND CASTINGS

	1945	1946
	<i>Weekly</i>	<i>Weekly</i>
	<i>Average</i>	<i>Average</i>
First quarter	233,200	242,600
Second quarter	227,200	252,100
Third quarter	211,300	230,000
September	240,700	238,500
October	243,200	254,300

WELDING MEMORANDA

A series of Welding Memoranda has been published by the Ministry of Supply as follows: No. 1, Specifying Welds on Drawings and the Control of Arc Welding Procedure; No. 2, Welding of High Tensile Steels; No. 3, Jigs and Manipulators for Fusion Welding; No. 4c, Resistance Welding Processes; No. 5, The Replacement of Drop Forgings and Pressings by Welded Parts; No. 7, Inspection of Arc Welded Work; No. 8, Inspection and Control of Quality of Spot Welds in Mild Steel; No. 9, Brazing; No. 10, Testing Arc and Gas Welders; No. 11, The Design of Welded Joints. Copies of each publication are obtainable from H.M. Stationery Office (price 6d.).

A CHEMIST'S BOOKSHELF

Protective and Decorative Coatings, Vol. V: Analysis and Testing Methods.

Edited by J. J. Mattiello. London: Chapman and Hall, pp. ix + 662. \$7.00.

This volume, which consists of five sections, each prepared by experts in their own particular fields, is concerned with the analysis of resins and plastics, drying oils, metal finishes and pigments. None of these fields presents an easy task to the analyst, and while much has been published in recent years on these topics, it is inconveniently scattered throughout the literature.

The first chapter deals with the analysis of resins, both natural and artificial. In view of opinions often expressed as to the impossibility of analysing any sample of a plastic less than 10 or 15 g., as contrasted with the minute amounts frequently demanding identification in industrial practice, it is interesting to note that this chapter is the work of two "analytical microscopists," who may be presumed to be undaunted by the difficulty of working with small amounts. These writers, making full use of microchemical techniques, indicate how far one can get with purely analytical methods, that is, those not involving actual microscopy.

Modern analysis can make much use of physical methods such as refractive index determination, or the investigation of ultra-violet and infra-red absorption spectra. Such methods are adequately covered in addition to the normal chemical processes. There is a wealth of information, which gives particular weight, because of space limitation, to the methods found most useful by the authors in practice. There is, in addition, a sufficient set of references to the more important literature of the subject.

The second chapter is concerned with the analysis of drying oils, once more an exceedingly complex field for the analyst. Here also full details are given for the most useful physical and chemical determinations which will aid, on the one hand, in the identification of an unknown oil, or, on the other hand, in the routine control of a manufacturing process.

In Chapter III we have a description of methods available for the laboratory testing of metal finishes for outdoor service. The methods of preparing test panels, the subsequent treatment, and the assessment of results are all clearly covered.

The spectral characteristics of pigments in the visual and infra-red regions—the range 4000 to 9000 Å.—form the subject matter of Chapter IV. After a description of the methods employed in measurement of the spectra, a comprehensive list of data is given for a wide range of commercial pigments. This includes, among other infor-

mation, the chemical nature and formula, the spectrophotometric curve for the pigment, and classifying methods which will aid towards its recognition.

Finally, the last chapter describes the application of the microscope in the examination of plastics. The methods of preparing samples, where necessary in the form of sections, and the requisite information about the use of the microscope, are comprehensively dealt with. The chapter is copiously illustrated with photomicrographs and other illustrations portraying a wide range of materials and the interpretation of their appearance under the microscope. This chapter forms a valuable supplement to the more orthodox chemical and physical methods of Chapter I.

To any analyst whose work may include the fields covered in this book, this is an essential reference work. It is full of useful information, it is finely produced and printed, and the many illustrations are above criticism.

C. L. WILSON.

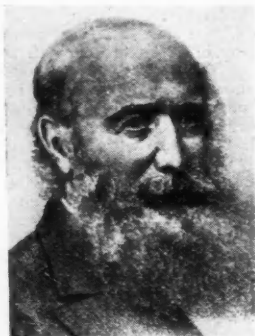
Plastics in the World of Tomorrow.

By Captain Burr W. Leyson. London: Paul Elek (Publishers), Ltd. Pp. 85. 10s. 6d.

The title of this book is self-explanatory and its main aim is to give those interested nowadays in the future potentialities of a developing new industry a survey of the shape and design of thousands of domestic and industrial articles to be made in plastics. It is written for the industrialist as well as for the layman and for young people looking for promising careers in this new industry. Part One is devoted to this, whereas Part Two deals with characteristics and industrial uses of the principal plastics. The subsequent three parts of the book describe plastics in the aircraft industry and the fabrication and other special uses of plastics. Thus the potential user is provided with adequate data which will give him at any rate the preliminary indications as to what specific plastics would serve his purpose. A brief review is provided of available technical literature. An appendix gives a list of trade names of materials dealt with in the text and in the 43 illustrations of this useful and commendable guide.

The pumping and elevating of corrosive liquids has been a speciality of the Kestner Evaporator & Engineering Co., Ltd., for many years. A great advance in acid pump manufacture is represented in the pumps now being produced by the company, these being not only glandless, but self-priming. Full details are given in the company's latest publication Leaflet 269a, "Pumps for Corrosive Liquids," copies of which are obtainable from the offices at 5 Grosvenor Gardens, Westminster, London, S.W.1.

A Chemical Centenary



The late Mr. Peter Spence, founder of Peter Spence & Sons, Ltd., of Manchester and Widnes. The company's centenary is being celebrated this month.

BRITISH COLOUR MAKERS

At the recent annual general meeting of the British Colour Makers' Association, the following were elected for the ensuing year: *Chairman*, Mr. S. K. Roberts (I.C.I., Ltd., Dyestuffs Division); *Vice-chairman*, Mr. H. G. Ferguson (Cornbrook Chemical Co., Ltd.); *Hon. treasurer*, Mr. C. G. A. Cowan (Cowan Brothers (Stratford), Ltd.); *Council*: Mr. S. K. Roberts (I.C.I., Ltd., Dyestuffs Division), Mr. H. G. Ferguson (Cornbrook Chemical Co., Ltd.), Mr. K. Burrell (J. W. & T. A. Smith, Ltd.), Mr. V. Watson (Cromford Colour Co., Ltd.), Mr. H. A. Wilson (Derby-Oxide & Colour Co., Ltd.), Mr. A. H. Orchard (Golden Valley Ochre & Oxide (Colours) Co., Ltd.), Mr. C. L. Lewis (Joseph Storey & Co., Ltd.), Mr. J. Crombie (James Anderson & Co. (Colours), Ltd.) (immediate past chairman), Mr. C. G. A. Cowan (Cowan Brothers (Stratford), Ltd.); *Secretary*, Mr. Allan J. Holden, B.Sc., F.R.I.C.

Manchester Oil Refinery, Ltd.

Manchester Oil Refinery, Ltd., announce that certain staff appointments within the company have been adjusted as follows: *general manager*, Mr. E. J. Dunstan, M.Sc., F.Inst.Pet.; *refinery manager*, Mr. J. C. Wood-Mallock, F.Inst.Pet., M.I.Gas E.; *secretary*, Mr. H. L. Morris. The managing directors are Dr. F. Kind, Ph.D. (Vind.), M.I.Pet. Tech., and Dr. G. Tugendhat, LL.D. (Vind.), M.Sc. (Econ.) (Lond.).

Personal Notes

DR. W. IDRIS JONES, F.R.I.C., director of research for the Powell Duffryn Co., has been appointed director-general of research for the National Coal Board.

PROFESSOR E. K. RIDEAL, F.R.S., Fullerian Professor of Chemistry, Royal Institution, is among the new members appointed by the Chancellor of the Exchequer to the University Grants Committee.

DR. D. C. MARTIN, general secretary of the Chemical Society, is to succeed Mr. J. D. Griffith Davies as assistant secretary of the Royal Society.

DR. W. H. GARRETT, production director to Monsanto Chemicals, Ltd., has been appointed a magistrate for the Ruabon district. He is vice-chairman of the Association of Chemical and Allied Employees, and for 15 years has been a member of the Chemical Trade Joint Industrial Council.

DR. J. B. SUMNER, of Cornell University, has been awarded the first half of this year's Nobel Chemistry Prize for his discovery of the crystallisability of enzymes. The second half of the Prize has been awarded jointly to DR. W. M. STANLEY and DR. J. H. NORTHROP, both of the Rockefeller Institute for Medical Research, Princeton, for researches into the purified production of enzymes and virus proteins.

MR. J. DAVIDSON PRATT, director and secretary of the Association of British Chemical Manufacturers, is a member of a British trade mission which has gone to Austria to investigate the possibilities of co-operation between British and Austrian industry and the speeding up of the economic recovery of Austria. Other members are MR. N. E. ROLLASON, of the British Iron and Steel Federation, and MR. H. L. STUBBS, of the British Non-Ferrous Smelters' Association.

Following the recent appointments by Monsanto Chemicals, Ltd., of MR. J. V. HEAD, as assistant purchasing manager, and of MR. W. M. THOMPSON, as home sales manager, the company has announced the reorganisation of its home sales department. MR. D. C. M. SALT, who has been with Monsanto for nearly twelve years, is now manager of the heavy chemical department in place of Mr. Head, and will be responsible for the sale of phenol, cresols, and similar products. The fine chemical department will be under the management of MR. J. S. M. DASHWOOD, B.Sc., A.R.I.C.

Obituary

PROFESSOR WILLIAM HENRY ROBERTS, who was Liverpool City Analyst for 34 years before his retirement, has died at Liverpool.

General News

The Gas Light and Coke Co. is planning to spend £10,000,000 on new plant in the next five years.

A Welsh Industries Fair is to be held in London for the first time, at the Royal Horticultural Halls, Westminster, from January 1-7.

The Royal Society announces that applications for Government grants for scientific investigations must be received before November 30.

The resumption of trading relations between Great Britain and Hungary for the first time since the war was announced on Monday in an official statement issued by the Board of Trade.

The primary vesting date for the transference of the coal mines to national ownership is to be January 1 next, according to a statement made by the Minister of Fuel in the House of Commons on Monday.

A phial of the new drug, streptomycin, was among the exhibits at the London Medical Exhibition held this week in the Royal Horticultural Society Hall, Westminster.

The Chemical Council's telephone number is REGent 2714-5, not REGent 1675-6, as stated in THE CHEMICAL AGE last week, the latter being the new number of the Chemical Society.

Courtaulds announce that their offer has been accepted for a site for a new viscose rayon fabric factory at East Haven, 15 miles from Dundee. It is hoped eventually to employ 1000 people there.

A Mining and Metallurgical Committee has been appointed by the Royal Anthropological Institute to investigate problems of early metallurgy as part of its scheme for group studies of the evolution of man.

The Royal Institute of Chemistry is asking the Privy Council to approve an alteration of the Institute bye-laws to enable it to hold future annual general meetings in April instead of in March as has been customary.

Uranium ore from the Belgian Congo has arrived at Liverpool. Contained in 1300 drums, and weighing more than 860 tons, it arrived on the Elder Dempster ship *Fulani*. The ultimate destination of the uranium is secret.

The Johnson Matthey Dramatic Society is presenting its second post-war play, "Death Takes a Holiday," at St. George's Hall, Tottenham Court Road, London, on the evenings of December 5, 6 and 7. Seats may be booked by telephoning Holborn 9277.

From Week to Week

The address of Technical Products, Ltd., has been changed to 112, Strand, London, W.C.2. (Tele.: TEMple Bar 4455; Telegrams: "Tecproduct, London"). A North of England office has been opened at 1, St. Mary's Parsonage, Manchester, 3. (Tele.: Blackfriars 0097)

The recent opening of the Dublin office of Burroughs Wellcome & Co., at 18, Merrion Square, was celebrated by a dinner at the Royal Hibernian Hotel, Dublin, attended by the Lord Mayor and by leading members of the medical, dental, veterinary and pharmaceutical professions in Ireland.

More than 70,000 German civil patent specifications, covering war-time developments in German industry and research, have been brought to Britain from the Berlin Patent Office and are open to inspection at the Patent Office Library, 25 Southampton Buildings, Chancery Lane, London, W.C.2. The specifications are in German. Photographic copies may be obtained at the rate of 6d. per page.

A trade delegation from Hungary has recently been in Britain discussing a renewal of trade between the two countries within the framework of the payments agreement lately concluded. Members saw representatives of British firms and trade organisations. Hungary can supply goods, including possibly manufactured goods, and the question of Britain and the sterling area exporting raw materials as well as goods was considered.

Potassium iodide has been added to Vitamin A and D tablets for expectant mothers. According to a Ministry of Food announcement, this addition has been made on the recommendation of the Standing Committee on Medical and Nutritional Problems and the Goitre Sub-Committee of the Medical Research Council. Each tablet will contain 0.13 mg. potassium iodide in addition to 4000 I.U. Vitamin A, 800 I.U. Vitamin D and 250 mg. B.P. calcium phosphate.

New light industries for Scotland are promised by the announcement that United States, Swedish, Dutch and Italian firms have been granted permission to set up factories there for the manufacture of such lines as cash registers, tractors, car accessories, light electrical equipment, radios, clothing and typewriters. A total of more than 120 firms, including some from the Midlands and Southern England, are establishing factories in Scotland, according to the Scottish regional commissioner of the Board of Trade.

British manufacturers of plastics will be represented at the 1947 British Industries Fair in much greater numbers than in former years, according to the *Board of Trade Journal*. Moulding powders and presses used in the production of plastic goods, also a varied display of finished articles, will be exhibited. This section is being organised in co-operation with the British Plastics Federation. The Fair will be held at Olympia and Earls Court, London, from May 5-16.

The problem facing scientists today, said Professor W. F. K. Wynne Jones, of University College, Dundee, speaking to the Royal Philosophical Society of Glasgow on "Freedom and Organisation in Science," was whether they were free or not to carry on experimenting when they found a phenomenon that might be a positive menace to mankind, such as the atomic bomb. It was impossible now for the scientist to sit back and say "I have no responsibility for my actions."

Despite less unemployment in the development areas, the number of people employed in Britain—20,400,000—was nearly a million fewer than in June, 1945, mainly because of married women leaving industry, stated the Minister of Labour at a trade union conference in Edinburgh last week. He said he expected the number to fall by a further 400,000 by the end of this year. Unemployed in the development areas had declined in number by 10,000 in the past month, but had risen over the country as a whole.

A new edition of the Raw Materials Guide, outlining the procedure for obtaining supplies and for effecting imports and exports of various raw materials, including a large number of substances used in the chemical industry, besides plastics and non-ferrous metals, has been published by the Board of Trade. It provides a summary of the current Statutory Rules and Orders affecting the commodities covered and the information is complementary to that given in *THE CHEMICAL AGE YEAR BOOK*. Copies of the Guide are obtainable from H.M. Stationery Office (1s. 6d.).

Imperial Chemical (Pharmaceuticals), Ltd., announce that the marketing of their products in Southern England is now being conducted through the I.C.I. regional and area offices in London and Bristol. All correspondence from South-East England should now be addressed to: Imperial Chemical (Pharmaceuticals), Ltd., Gloucester House, 149, Park Lane, London, W.1, (Tele: Grosvenor 4020; telegrams: Chemind, Telex, London). Correspondence from the western area should be addressed to: Imperial Chemical (Pharmaceuticals), Ltd., Eagle House, Colston Avenue, Bristol. (Tele.: Bristol 20051; telegrams: Impkemix, Bristol).

Foreign News

Deposits of vanadium have been discovered in Kazakhstan.

An Argentine national five-year plan includes expenditure of 620 million pesos for oilfields.

An "electronic brain" is reported to have been constructed by the Electrotechnical Institute of the Soviet Union.

A new element, curium 242, the heaviest substance yet known, has been produced in the U.S.A. by bombardment of platinum with alpha particles.

Because of the shortage of vegetable oils in the Union of South Africa, the Department of Agriculture is taking steps to increase the production of groundnuts.

Expected to produce 350,000 tons of ammonium sulphate a year, the proposed fertiliser factory in Bihar, India, is now "well under way." It is officially reported.

UNRRA has purchased 15,000 tons of artificial fertiliser in the Soviet Russian zone of occupation of Germany, to be distributed to Austria, Czechoslovakia and Yugoslavia.

With the completion of experimental alumina operations, the Columbia Metals Alumina plant at Salem, Oregon, U.S.A., is to be devoted to the production of sulphate of ammonia at a rate of 200 tons a day.

The Brazilian Petroleum Council has been accorded authority to set up a limited liability company to be styled "Refineria Nacional de Petróleo," for the purpose of refining national petroleum.

The Austrian mining authorities have decided on a radical reorganisation and intensification of the whole mining industry, especially coal and iron ore, mainly by way of offering premiums for production.

The sugar refinery at Enns, Upper Austria, has resumed production again with more than 700 workers. Following a very good sugar-beet harvest, output is regarded as very promising.

Italian interests have offered 3000 flasks (76 lb. each) of mercury in the New York market at a c.i.f. price of \$83.50 per flask, as compared with the American quotation of \$96 to \$99 per flask, free New York.

Several new schemes are projected for the Indian Council of Scientific and Industrial Research, including atomic research; research on nuclear physics; and preparation of tannic acid from myrobalans.

Russian whaling plans are reported to have aroused much interest in Oslo. Swedish machines have been installed in a Russian floating factory and the Russians have repaired German catchers. It is believed likely that the Russians will catch in the Antarctic next season.

Forthcoming Events

November 25. Institution of the Rubber Industry. Engineers' Club, Manchester, 6.15 p.m. Mr. Maldwyn Jones: "The Impact of Plastics on the Rubber Industry."

November 25. Royal Institute of Chemistry (London and S.E. Counties Section). The College, High Street, Acton, W.3, 7.30 p.m. Scientific film show.

November 26. Royal Institute of Chemistry (London and S.E. Counties Section). The County School, Isleworth, 7.30 p.m. Scientific film show.

November 26. Society of Public Analysts (Physical Methods Group). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1. Mr. J. T. Stock, Mr. Airey, Dr. C. J. O. R. Morris: "Polarographic Analysis."

November 27. Institute of Welding. Institution of Civil Engineers, Great George Street, Westminster, S.W.1. Mr. E. Fuchs, Dr. L. Mullins, Mr. S. H. Smith: "The Inspector's Approach to Radiographs of M.S. Butt Welds."

November 27. Society of Chemical Industry (Food Group, Microbiological Panel). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 6.15 p.m. Mr. H. C. S. De Whalley and Miss M. P. Scarr: "Micro-organisms in Raw and Refined Sugar and Intermediate Products."

November 28. Royal Statistical Society (Industrial Applications Section) (Sheffield Group). The University, Sheffield, 1, 6.30 p.m. Mr. D. Newman: "The Efficiency of 100 per cent Inspection."

November 28. Royal Institute of Chemistry (Liverpool and North-Western Section) (jointly with S.C.I., Chemical Society and B.A.C.). The University, Liverpool, 7 p.m. Mr. A. V. Billingham: "The Development and Industrial Application of Wetting Agents."

November 29. Royal Institute of Chemistry (Cardiff and District Section) (jointly with S.C.I.). University College, Cathays Park, Cardiff, 7 p.m. Dr. D. T. A. Townend: "Recent Developments in Combustion."

November 30. Institution of Chemical Engineers (North-Western Branch). College of Technology, Manchester, 3 p.m. Mr. K. A. Sherwin: "The Concentration of Caustic Soda Solution."

December 2. Society of Chemical Industry (London Section). Chemical Society's Rooms, Burlington House, Piccadilly, London, W.1, 8 p.m. Dr. N. O. Clark: "Foams and Fire Fighting."

Company News

The nominal capital of **Anglamol, Ltd.**, 6 Booth Street, Manchester, has been increased beyond the registered capital of £1000, by £9000, in £1 ordinary shares.

The **Beecham Group** announces a second interim of 8½ per cent on its deferred shares, on account of the year ending March 31 next, compared with 7½ per cent. The total distribution for 1945-46 was 36 per cent, including a victory bonus of 4 per cent. The present payment will bring dividends for the current year to 17 per cent to date, against 15 per cent at this time last year.

New Companies Registered

Chemical and Manufacturing Products, Ltd. (423,184).—Private company. Capital £1000 in £1 shares. Subscribers: J. Solsona, 42 Kenton Road, Harrow (first director); E. Ashing; Rodriguez Gyrmko.

Sales Products Research & Development Co., Ltd. (423,380).—Private company. Capital £1000 in 1s. shares. Manufacturing and analytical chemists, etc. Directors: E. C. Thorne, J. C. Clark. Registered office: 514 Ipswich Road, Trading Estate, Slough.

H. S. Walker and Co., Ltd. (423,295).—Private company. Capital £3000 in £1 shares. Manufacturers of and dealers in chemical and other preparations, etc. Directors: Hugh S. Taylor, John F. Murphy, Roy Cuzner. Registered office: 170 Kensington High Street, London, W.8.

Chemical and Allied Stocks and Shares

POLITICAL uncertainties have again had a curbing influence on stock markets, and British Funds became less firm with industrial shares reflecting a little profit-taking. Home rails were adjusted to the compensation values proposed by the Government, but the latter came in for considerable criticism as not being fair to stockholders because there is a strong case for the question of compensation being decided by an independent tribunal. Iron and steels, after responding to the industry's latest production figures, eased in accordance with the general market tendency, and colliery shares attracted less attention following the announcement of January 1 as the vesting date. Later, there was a good deal of selling of home rails for reinvestment in industrial shares.

Chemical and kindred shares were not immune from the uncertain trend of markets, Imperial Chemical easing to 42s. 10½d.

but later improving to 43s. 4½d., while Fisons were 57s. 9d., Burt Boulton 26s. 9d., although H. Laporte remained at 98s. 1½d. Greiff-Chemicals Holdings 5s. ordinary were 12s. 6d., Monsanto Chemicals 5½ per cent preference 23s., and Stevenson & Howell 5s. ordinary 30s. 6d. xd. Lever & Unilever firmed up to 48s. on the full results, and Turner & Newall were steady at 86s. 6d. awaiting the dividend announcement. United Molasses moved up to 55s., while the units of the Distillers Co. were 136s., the interim dividend being due shortly. Borax Consolidated at 47s. 3d. showed firmness, higher dividend hopes persisting for the financial year ended September 30. Barry & Staines improved to 55s. British Glues & Chemicals 4s. ordinary held their rise to 17s. and the participating preference shares moved up to 46s. British Match displayed firmness at 50s., British Aluminium have been steady at 44s. 9d., and British Oxygen were 101s. 3d., but following the annual meeting, Triplex Glass 10s. ordinary receded to 35s. Among paint shares the tendency became steadier with Lewis Berger higher at £6 15/16 on the company's new factory plans and on hopes of an increase in the pending dividend. Following the dividend increase, Imperial Smelting firmed up to 20s. 3d. xd. De La Rue eased to £13½, but elsewhere, General Refractories were favoured up to 20s. 3d.

Among iron and steels, gains predominated on balance, although best levels were not held. Guest Keen, after 45s. 9d., eased to 45s. 3d., United Steel were 26s., and Ruston & Hornsby 62s., while Babcock & Wilcox rose to 67s. 6d., but later eased to 67s. Powell Duffryn strengthened to 26s., but colliery shares generally became less active. Associated Cement eased to 67s. British Plaster Board were 32s. 6d. on the unchanged interim. Shares considered to have bonus prospects attracted rather more attention on renewed hopes that the ban on share bonuses may be modified. Vickers, and Qualcast were among shares to improve in this connection, but earlier gains were not fully held.

Boots Drug strengthened to 61s. 3d. also helped by talk of future bonus possibilities. Beechams deferred were good at 26s. 10½d. xd. on the higher interim payment, Timothy Whites were 45s. 6d., Sangers 33s. 9d., and Griffiths Hughes strengthened to 61s. In other directions, Tube Investments have rallied to £6½ xd on further consideration of the past year's results. British Drug Houses receded to 55s. 9d., and textiles were less firm, although on balance, Lancashire Cotton Corporation ordinary have recorded a good rise, awaiting the forthcoming dividend. Dunlop Rubber at 70s. 9d. lost a few pence, but later rose to 72s. 6d. Oil shares became less firm, with Shell 90s. 7½d., Anglo-Iranian 95s. 7½d., and Burmah Oil

67s. 6d. C. C. Wakefield showed firmness around 70s. on talk of a second interim dividend.

British Chemical Prices

Market Reports

THE London industrial chemicals market has been without feature this week, although a strong undertone has been displayed in most sections, with prices showing an upward tendency. The call from users for deliveries under existing contracts has covered good volumes, and demand generally continues steady, with many orders both for home and export still to be placed. The potash and soda products sections are mainly unchanged, with supplies of a number of items continuing tight. Conditions in the coal-tar products market show little change on the week. Pressure for contract deliveries is the chief note and a firm price position is maintained.

MANCHESTER.—Fresh inquiries on the Manchester chemical market during the past week have again included a fair number on export account and no lack of new business in the general run of heavy products is available. In a number of instances, however, the supply position is tight and is becoming increasingly so. In these circumstances it is less easy to arrange firm delivery dates. The soda compounds generally are in good demand and a steady absorption of supplies of the general run of potash chemicals as offers are made is reported. A ready outlet from the mineral acids is a feature of the market. With an odd exception there is a brisk demand for the coal-tar products, both light and heavy, and new buying interest is strongly in evidence.

GLASGOW.—A heavy demand has been experienced in the past week for all materials available for delivery, and orders for forward delivery have been on the late scale. There is the usual activity in synthetic detergents and soap substitutes and a strong demand for whitening, formaldehyd, Glaubers salts, Epsom salts, DDT insecticides, soda ash, caustic soda, etc. The supply position has shown no sign of improvement and prices remain very firm, with a tendency to rise, as in the case of copper sulphate and zinc oxide. In the export market conditions were again very active and considerable business has been accepted for magnesium sulphate, copper sulphate, sulphuric acid, caustic soda, soda crystals, hydrofluoric acid, zinc oxide, and a large range of tanning chemicals, textile chemicals, and other raw materials. In this market also prices remain very firm.

Price Changes

Charcoal: Lump, £24 per ton. Granulated, £30 per ton, on rail.

Inventions in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted may be obtained from the Patent Office, Southampton Buildings, London, W.C.2., at 1s. each. Numbers given under "Applications for Patents" are for reference in all correspondence up to acceptance of the complete specification.

Applications for Patents

Coating magnetic materials.—British Thomson-Houston Co., Ltd. 31263.
Cathode-ray tubes.—British Thomson-Houston Co., Ltd. 31260.
Cathode-ray tubes.—D. A. G. Broad. 30991.
Insecticides.—S. P. Cantero. 31157.
Imidazolines.—Ciba, Ltd. 30820-21.
Manufacture of fuel.—C. J. Coleman. 31133.
Metal coatings.—W. T. Davies, H. E. Gresham, and M. A. Wheeler. 30861.
Flocculation of solids.—De Directre Van de Staatsnlynen in Limburg, Landelend Voor en Namens den Staat der Nederlanden. 31128.
Crystalliser heating apparatus.—F. B. Dehn. (Stearns-Roger Manufacturing Co.) 31243.
Aqueous dispersions.—E. I. Du Pont de Nemours & Co. 30759.
Acetylenic hydrocarbons.—E. I. Du Pont de Nemours & Co. 31061.
Plastic compositions.—E. I. Du Pont de Nemours & Co. 31062.
Synthetic latex.—B. F. Goodrich Co. 30647.
Organic compounds.—B. F. Goodrich Co. 30648.
Aromatic carboxylic acids.—B. F. Goodrich Co. 30649.
Trichloroethane.—B. F. Goodrich Co. 30780.
Halomaleate copolymers.—B. F. Goodrich Co. 30781.
Organic compounds.—W. H. Groombridge. 30854.
Hydrogenation, etc., production.—J. J. R. Guichard. 31214.
Hydrocarbon conversion.—Houdry Process Corporation. 31244.
Triazines.—R. M. Hughes. (J. R. Geigy A.G.) 30756.
Dehydroanthracene derivatives.—R. H. Hughes. (J. R. Geigy A.G.) 30757.
Resinous products.—International Plastics Ltd., V. E. Yarsley, and C. A. Minois. 31191.
Purifying agents.—L. M. Jenesa, and J. Polasek. 31234.
Brazing, etc., alloys.—R. C. Jewell, and Sheffield Smelting Co., Ltd. 31102.
Toxic organic compounds.—M & P. Colloid Stabilisers, Ltd., and J. May. 31094.
Contacting liquids with gases.—N.V. de Bataafsche Petroleum Maatschappij. 30720.
Crude tar distillation.—Newton, Chambers & Co., Ltd., and L. S. Brown. 30848.
Chemical reactions.—Oreal Soc. Anon. 31226.
Soap purifying.—Oreal Soc. Anon. 31227.

Oxygen diffusers.—L. Orlow. 31241.
Organic compounds.—H. F. Oxley, and E. B. Thomas. 30853-55.
Recovery of silver from solutions.—Permutit Co., Ltd. 30697.
Recovery of metal from solutions.—Permutit Co., Ltd. 30698.
Synthetic resins.—L. N. Phillips. 30809.
Plasticisers.—G. F. Rayner. (American Viscose Corporation.) 30761.
Synthetic waxes.—C. T. Richards. 30613.
Organo silicon resins.—Westinghouse Electric International Co. 30651.
Sheer plastics.—F. C. Wybrew. 30862.
Bonded granular articles.—A. Abbey. (Carborundum Co.) 31514.
Condensation products.—Algemeene Kunstzijde Unie N.V. 31613-4.
Alloys.—Alloy Research Corporation. 31459.
Treatment of hydrocarbon mixtures.—C. Arnold. (Standard Oil Development Co.) 31961.
Hydrocarbon polymers.—C. Arnold. (Standard Oil Development Co.) 31962.
Catalysis of organic products.—D. Balachowsky. 31469.
Plastic coating of materials.—F. Begley, and L. Begley. 31317.
Thermo plastics.—F. Begley, and L. Begley. 31318.
Concentration of latex.—British Rubber Producers' Association, Ltd. (J. H. Piddford.) 31884.
Boron compounds.—British Thomson-Houston Co., Ltd. 31379-80.
Organoboron compounds.—British Thomson-Houston Co., Ltd. 31753.
Organic compositions.—California Research Corporation. 31387.
Alkali metal selenides.—California Research Corporation. 31388.
Sulphur compounds.—California Research Corporation. 31389.
Tungsten alloys.—Callite Tungsten Corporation. 31508.
Purification of water.—Carbonisation et Charbons Actifs. 31478.
Penicillin.—Carbonisation et Charbons Actifs. 31479.

Complete Specifications Open to Public Inspection

Centrifugal separation of sludge-containing liquids.—A/B Separator. April 18, 1945. 10758/46.
Preparation of culture or fermentation liquors to be used as a medium for obtaining industrial products.—Bioquimea Española Soc. Anon. April 17, 1945. 30155/45.
Volatiliser of liquids.—P. Bokor. April 19, 1945. 11704/46.
Mixtures of polyoxyalkylene diols.—Car-

bide & Carbon Chemicals Corporation. April 21, 1945. 11604/46.

Method for alcoylating aromatic hydrocarbons.—Compagnie Française de Raffinage. April 18, 1945. 20734/46.

Evaporation of water from concentrated solutions of calcium nitrate.—Directie Van de Staatsmijnen in Limburg. Nov. 17, 1941. 27771/46.

Removal of fluorine from acid nitrate containing solutions.—Directie Van de Staatsmijnen in Limburg. June 5, 1942. 27772/46.

Production of acid calcium phosphates and of calcium nitrate from raw phosphate and nitric acid.—Directie Van de Staatsmijnen in Limburg. Sept. 5, 1942. 27773/46.

Production of calcium phosphate.—Directie Van de Staatsmijnen in Limburg. April 4, 1941. 27774/46.

Cyclic process for producing dicalcium phosphate by reacting raw phosphate with phosphoric acid and hydrolysis of the reaction mixture.—Directie Van de Staatsmijnen in Limburg. April 30, 1942. 27775/46.

Protection of metal surfaces.—E.I. Du Pont de Nemours & Co. June 15, 1943. 11355/44.

Preparation of interpolymers.—E.I. Du Pont de Nemours & Co. April 21, 1945. 11831/46.

Production of chromable azo dyestuffs.—J. R. Geigy A.G. April 17, 1945. 11664/46.

Pyrilium dye salts as filter and anti-halation dyes in photographic materials.—General Aniline & Film Corporation. April 17, 1945. 12234/46.

Manufacture of aqueous dispersions of synthetic linear polyamides.—I.C.I., Ltd. April 20, 1945. 11828/46.

Preparing fertilisers.—Produits Chimiques du Limbourg S.A. April 19, 1945. 10873/45.

Preparation of metallisable polyazo dyestuffs.—Sandoz, Ltd. April 16, 1945. 11662/46.

Processes for producing products containing copper oxychloride.—Sirco A.G. April 19, 1945. 11046/46.

Textiles dyed with vat dyestuffs.—Soc. of Chemical Industry in Basle. Jan. 6, 1942. 175/44.

Inhibition of oxidation and like deterioration in hydrocarbons.—Standard Oil Development Co. Dec. 31, 1942. 16567/43.

Curing olefine-dioline copolymers.—United States Rubber Co. Jan. 15, 1944. 20808/44.

Manufacture of methionine.—U.S. Industrial Chemicals, Inc. April 17, 1945. 34960/45.

Manufacturing ferrous bodies containing silicon.—American Electro Metal Corporation. April 28, 1945. 8693/46.

Methods of preparing silicone resins.—British Thomson-Houston Co., Ltd. Feb. 12, 1944. 3253/45.

Formation of solutions of polymeric mate-

rials.—E.I. Du Pont de Nemours & Co. June 23, 1943. 11946/44.

Coating of fabrics.—E.I. Du Pont de Nemours & Co. April 27, 1945. 12643/46.

Dyes and particularly photographic sensitising dyes.—E.I. Du Pont de Nemours & Co. April 28, 1945. 12650/46.

Therapeutically active hydrazo-compounds containing arsenic radicals and process of preparing same.—E. A. H. Friedheim, Oct. 31, 1942. 17747/43.

Production of monoazo dyestuffs.—J. G. Geigy A.G. April 26, 1945. 12494/46.

Polymerisation of methyl methacrylate in the presence of aliphatic thiols.—I.C.I. Ltd. March 20, 1943. 5138/44.

Vulcanising froth sponge.—I.C.I., Ltd. April 24, 1945. 11829/46.

Production of alkali metal perborate compositions.—I.C.I., Ltd. April 28, 1945. 12831/46.

Manufacture of amino-aldehyde adhesives.—I. F. Laucks, Inc. April 24, 1945. 10338/46.

Processing of oleaginous material.—Lever Bros. & Unilever, Ltd. April 26, 1945. 12612/46.

Apparatus for determining the vapour content of a gas.—A. D. Little, Inc. April 25, 1945. 7258/46.

Complete Specifications Accepted

Process for heat-treating and stretching untwisted yarn consisting of a polymer of acrylonitrile.—E.I. Du Pont de Nemours & Co. Aug. 20, 1943. 581,526.

Production of vinyl and ethylidene esters.—E.I. Du Pont de Nemours & Co. Sept. 24, 1943. 581,627.

Manufacture of fluorine-containing compounds.—E.I. Du Pont de Nemours & Co. Sept. 24, 1943. 581,628.

Manufacture of organic fluorine compounds.—E.I. Du Pont de Nemours & Co. Oct. 4, 1943. 581,662.

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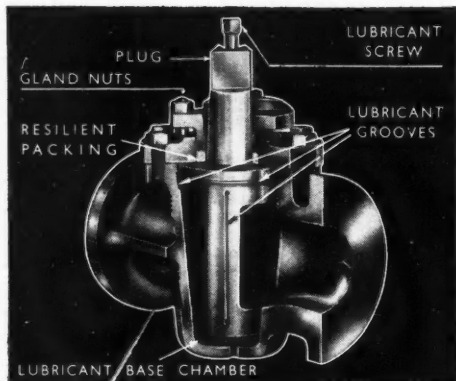
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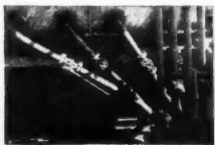
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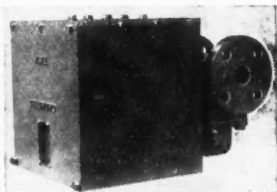
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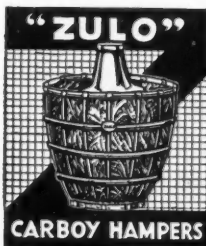
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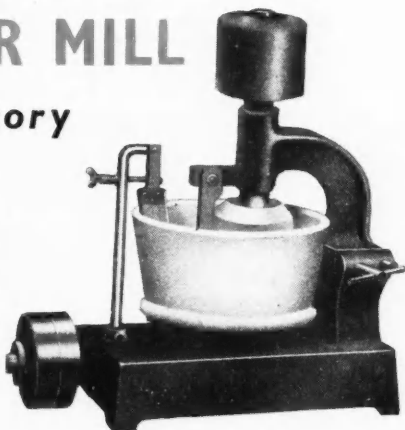
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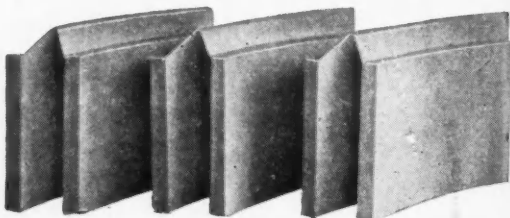
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